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### 08 Forced Upgrades

Have you upgraded to Windows 10 recently? No? Are you sure? You might think that's a simple question to answer (and it should be), but it seems a lot of people are finding they've upgraded to Microsoft's latest OS without ever actually choosing to do so. The reason for this, of course, is the company's underhanded methods of getting this software on users' computers, as David Crookes explains

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Whether you're a gamer or not, high-end peripherals designed for gaming can demand some pretty high prices. They also come with the kind of features you won't normally find in basic office equipment, though. The good news is there are also plenty of more affordable gaming peripherals to be found, as we've been finding out

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As well as giving us an excuse to mention Scotty talking to a computer mouse in *Star Trek IV*, Cortana is also a genuinely useful addition to Windows. It also has a lot more depth than you might think, so to help you get the most from Microsoft's chatty new friend, Roland Waddilove has a handy selection of tips and tricks

### 50 Group Test: Laser Printers

Once expensive items reserved for busy offices, colour laser printers are now well within reach of home users. With running costs that can be as low as 1p a page, if you do a lot of printing these are a great route to take. To help you choose the right one for your needs, we've been checking out six models you can buy right now



# 50 Group Test: Laser Printers



# 58 Guide To GitHub



## 58 Guide To GitHub

Whether you're a Linux developer or an ordinary user, GitHub should be on your radar. In around six years, this cloud-based development repository has become one of the most essential resources for the open-source community. David Briddocks takes a look at what it is, how it works and how you can get involved in it yourself

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Virtual reality, artificial intelligence, drones, lasers and telepathy: it all sounds like the makings of a sci-fi novel. Yet these are, in fact, areas of technology that Facebook is involved in, and which it sees as part of the future of the corporation. Of course, things don't always go according to plan, but we've been looking at what could be heading our way courtesy of Mr. Zuckerberg and co.

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# Windows 10 And Forced Upgrades

**As Microsoft foists Windows 10 onto Windows 7 and 8 users,  
David Crookes examines the effects of this aggressive strategy**



**W**indows 10 is doing well. With 14.15% of the market, it's now the second most popular operating system in the world, more than edging Windows 8.1 into third place (and old faithful Windows XP into fourth). Installations for March were 25% higher than in February, according to the analytics vendor Net Applications, and of those who have tried the OS, the majority are happy with what they see.

But there's an elephant in the room called Windows 7, which Microsoft wants to push out with all its might. It wants to heave and ho and shove this unwanted bulk onto the streets so it may wither and die and become a distant memory. Yet with 51.89% of the market, this old OS is proving to be one stubborn beast, and it shows no signs of being in a minority just yet.

Microsoft has been trying hard. When it unveiled Windows 10, its aim was to rapidly replace all that had gone before. Windows 10 was purported to be a fresh start, a new OS that – in skipping right past a Windows 9 – was all set to put some distance between the future and the past. But although it has been used by at least 270 million people in the past month, the task of getting folk to upgrade in even greater numbers has proven to be more difficult than at first imagined.

Over the past few months, we've seen what appears to be a change in tactics by the Redmond-based giant. At first, it was all very friendly ("Hey, here's a new operating system, why not give it a go; you'll love it – honestly you will"). But then it became something that Microsoft really, really wanted you to have. To hammer that point home, Windows 10 ceased to be an optional update this year and instead became a recommended one.

This changed everything. For those systems that are set to automatically process recommended updates, it amounted to pushing Windows 10 onto a machine. Users would not only find the OS controversially and quietly downloaded onto their system in the background but actually installed. Waking up to a whole new OS on a computer can be rather disconcerting and yet that's just what has been happening.

## “Windows is continuing to find its way onto machines to the surprise of users”

Windows watchers had seen this coming. Analyst Gartner predicted the migration to Windows 10 would become the fastest yet after Microsoft switched Windows 10 to a recommended update. But it has left a bitter taste in the mouths of many a user.

### Through The Window

In order to persuade people that the migration to Windows 10 is a good thing, Microsoft's rhetoric has been in overdrive. In February, the company's chief marketing officer, Chris Capossela, issued a stark warning of the risks involved in using Windows 7. The OS, he said, was less secure than Windows 10, and it ran into problems when installing newer software.

"We do worry, when people are running an operating system that's ten years old, that the next printer they buy isn't going to work well. Or they buy a new game ... a very popular game, and it doesn't work on a bunch of older

machines," he told Windows Weekly. "And so, as we are pushing our ISV [Independent Software Vendor] and hardware partners to build great new stuff that takes advantage of Windows 10, that obviously makes the old stuff really bad – and not to mention viruses and security problems."

He went on to say that it was almost Microsoft's duty to get people upgraded, as if those poor people using older OSs

– namely Windows 7 and 8/8.1 – were vulnerable and deserved protection. "It is hard to move anyone to a new model without angering some people," Capossela continued. "We don't want to anger anybody, but we do feel a responsibility to get people to a much better place, and Windows 10 is a much better place than Windows 7."

But is it? Well, it's certainly true that Windows 10 represents the future of Microsoft's operating system, and there's nothing inherently wrong with it. It follows the usual path of 'bad OS, good OS' to the last letter and it has a wide range of superb tools and smarter apps. The early problems of lost sound and incompatible drivers have been resolved, and Cortana is proving useful. The browser Edge has improved HTML5 and CSS3 support, and the expanded Smart menu is a treat.

But to suggest that Windows 7 is somehow unsafe says more about Microsoft than the motivation of the users: the company has promised extended support for Windows 7 until 14th January 2020, so it has a duty to close security loopholes. Indeed, Windows 8 mainstream support ends on 9th January 2018 and extended support on 10th January 2023. Even Windows Vista is set to enjoy extended support until 11th April 2017.

As for whether or not a new printer would fail to work with Windows 7, it's again something for manufacturers to consider, not the users. If a printer company wants to cut out more than half of the Windows userbase, it's unlikely to be thanked by its balance sheet. But Microsoft wants Windows 10 on a billion devices, and it seems determined to





achieve its ambition, even if it's leaving a nasty taste in the mouths of a fair few users, a good number of whom have headed online to vent their spleen.

## Reddit All About It

One of the problems is that Microsoft has been at this point before. In October 2015, it ended up apologising for delivering notifications from Windows Update that Windows 10 had been downloaded and was ready to be installed. The optional update was checked by default, so it meant that the prompt was being seen by people who had never tried to upgrade and who hadn't sought to reserve a copy. But come February, the same notifications began to appear, and that got a lot of people's backs up.

Some of the subsequent discussions took place on Reddit, where users are not known for holding back their thoughts. In a thread called "Warning: Windows 7 computers are being reported as automatically starting the Windows 10 upgrade without permission", users spoke of their problems with Microsoft forcing through the updates.

"Went afk [away from keyboard] and saw this message box that said something like 'Your update is ready! Restarting and installing in 13 minutes'," said one user. "If I made myself a meal or watched TV, I would have had Windows 10. Oh, and the best part is how they hid the 'Decline' button in the More Info button."

"Yep this happened to me this morning," added another. "Working and all of a sudden Windows closed all my programs, logged me out and started the upgrade. I quickly shut down my computer and was able to stop it but

my son wasn't so lucky. Same thing happened to him today."

As if to underline the problems it has been causing, yet another – who appears to work for an IT company – wrote: "We've been getting calls trickling in all week from doctor's offices, dental practices, B&Bs and roofing companies – among others – that have been hit by this and it's a \*\*\*\*ing mess. In some cases the upgrade went OK and the user is just really confused. In others, Windows 10 is asking for a login password the user set years ago and hasn't used since – that

“ It feels like someone broke into my house, installed spyware on my computer and rendered my favourite applications useless ”

was fun. In still another it's screwed up access to their shared folders. I'm >this< close to telling the techs to disable automatic updates completely for all business customers."

And so they go on. "I thought my ex was crazy when she said her computer just randomly rebooted and started installing Windows 10. I guess she isn't crazy, at least on this one thing"; "It happened to me last week. I'm still furious. It feels like someone broke into my house, installed spyware on my computer and rendered my favourite applications useless"; "I struggle to believe some people here can't understand why a forced change may

be a problem for some people. Here's a simple one: Some software is not compatible with W10. End of debate."

Except it isn't. Windows is continuing to find its way onto machines to the surprise of users, and anyone who doesn't want it is being told the same thing: that there's a 31-day period in which you can revert back to the previous OS. It could be argued that this is a little underhand; why should someone go through the hassle of rolling back an OS to an older version when they didn't want the new one in the first place? But when you think

that most people are likely to shrug and stick with it, not really knowing what has happened, this is actually a canny way of getting Windows 10 in front of people's eyes. Besides, even if someone ends up hating it, there's every chance that the user won't be able to figure out how to roll it back. Not everyone in the world is an IT expert, after all.

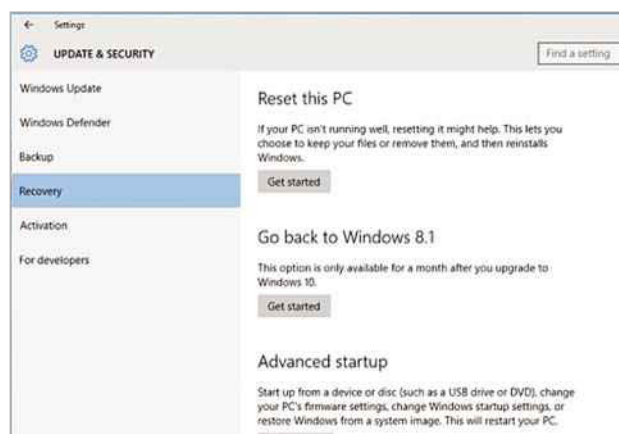
So just what are you able to do about this? How can you head off this problem? Thankfully, there is a way to ensure that Windows 7 remains on your machine up until the time you actually want to upgrade. But before we get to that, let's address one of the reasons why you really need to make up your

## 31 Days And Counting

Has Windows 10 been installed on your computer without your say-so, and would you like to roll back to a previous version? You can do that as long as you take action within the 31-day window, otherwise – unless you're willing to take drastic action – you'll be stuck with it.

The main way to resolve the problem involves going to Settings and selecting Update and Security before selecting Recovery. After a short while, the older, more familiar desktop will appear once more, and this is the best option, because all your data will remain intact.

The alternative is far less straightforward. Microsoft says you can either roll back to a manufacturer's factory settings, as long as the option has been provided, or physically reinstall an older OS using the product key that you were provided with. Neither are without their hassles.





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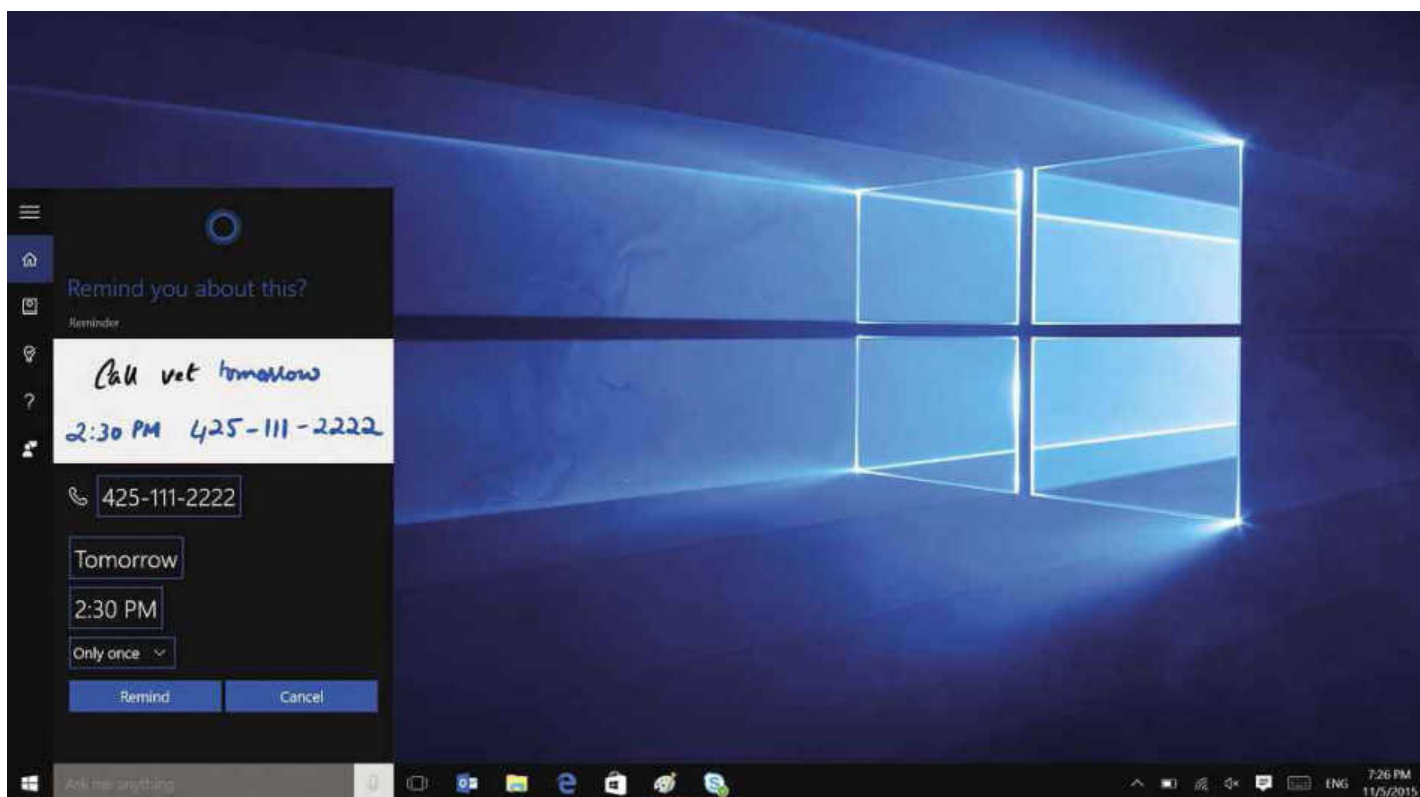
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mind right now. Unsurprisingly, it relates to cold, hard cash.

## Free Windows

When Microsoft announced Windows 10, it said users would be able to upgrade for free. It promised that it wouldn't be a 'lite' or beta version of the OS but would be the full operating system in all of its perceived glory. In this, it was following in the footsteps of Apple, which has been giving away its Mac operating system, OS X, since 2013. But unlike Apple, it introduced a deadline. The free offer, Microsoft said, was for a limited time only.

The deal was that users could upgrade for exactly one year following its release. Since it was made generally available on 29th July 2015, that has meant people have until that date this year in order to make up their mind. After that date, it'll be a case of getting out your wallet and paying for the upgrade – some may say that looking to beat the deadline is the ultimate forced update, but at least with this one, the aim was stated at the very start.

We can expect this date to crop up numerous times in adverts and online over the next few weeks. Anyone with Windows 7 Service Pack 1 or Windows 8.1 Update will be prompted to seriously

think about whether they want to take the plunge or else risk having to spend £99.99 for the Home edition and £189.99 for Pro further down the line. This is the only option for those running XP or Vista and, come late summer, it'll be the only available path for everyone else too.

It means you may regret ruling out an upgrade today, although it could be that you're willing to wait until you eventually buy a new computer, in which case you could keep working with Windows 7 right now and move 'up' the ladder only when you're ready to.

It's also worth pointing out that you get the equivalent version of Windows

## Never 10

If you prefer an app to do the legwork for you when it comes to preventing your machine from downloading and installing Windows 10, then software developer Steve Gibson has come up with the answer.

Never 10 ([www.grc.com/never10.htm](http://www.grc.com/never10.htm)) lets you disable automatic updates by performing the system editing on your behalf. It hides in the background and monitors any attempt by Microsoft to upgrade your system.

In order to work, it needs backdoor access, which was granted by the Windows Update version released in July 2015. From that point on, it will stop any annoying prompts or installations, but if you do decide at a later date that you would like to upgrade, it won't step in your way.





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to the one that you're currently on. So if you have Windows 7 Starter, Home Basic, Home Premium or Windows 8.1, you'll end up with Windows 10 Home, and if you have Windows 7 Professional, Ultimate or Windows 8.1 Pro, you'll get Windows 10 Pro. Those wanting to jump a level shouldn't feel pressured to do anything at this point.

What, then, should you do if you decide you don't want to upgrade? Some may be attempted to turn Windows Update off. Doing this will definitely prevent you from inadvertently installing Windows 10, but it will also prevent you from receiving security patches, so it's not advisable to do. Instead, you want to turn off the specific instruction that allows the Windows 10 upgrade function to appear on your machine, and the first thing you ought to know is that the update appears under the name KB3035583, which makes it all very mysterious and baffling to those out of the loop.

Anyway, on to the instructions. Microsoft's official advice on its support page is to do one of two things: go via Computer Configuration or make changes to the registry. In the first instance, you need to click 'Computer Configuration', go to 'Policies' and select 'Administrative Templates', and then click 'Windows Components' and "Windows Update in turn. Now double-click 'Turn off the upgrade to the latest version of Windows

through Windows Update', and you should be safe from future nags.

Alternatively, open the registry editor, which you'll be able to find by opening the Start menu and searching for regedit. Then, in HKLM\SOFTWARE\Policies\Microsoft\Windows\WindowsUpdate, set DisableOSUpgrade to 1 and in HKLM\Software\Microsoft\Windows\CurrentVersion\WindowsUpdate\OSUpgrade, set 'ReservationsAllowed' to 0.

## “ The company has promised extended support for Windows 7 until 14th January 2020 ”

But what if KB3035583 has already got through? In this case, you'll need to remove the update, so go to Windows Updates (look for it using the search bar in the Start menu) and select 'View Update History'. 'Installed Updates' will be displayed on the pop-up, so click on it and search for KB3035583. By right-clicking and selecting Uninstall, you'll be taken through the necessary steps and promoted to restart your machine. It won't be the end of the matter, because now KB3035583 will be shown as being a

recommended update, but going through the steps we went through earlier would solve that (you can also right-click and select 'Hide').

### More Upgrades

The problem of Windows 10 being forced on users is only part of the story, though. A pair of automatic Windows 10 updates in April – KB3147461 and KB3147458 – have been causing some major headaches, which have again highlighted

the problems of new feature sets being forced on people. Not having updates automatically installed allows users to take a step back as they wait for the various flaws to be ironed out. When they just land, millions begin to feel the effects almost immediately.

According to various reports, critical error pop-ups, blue screens of death, and PCs that install the updates, restart and try to reinstall them again and again have been noted. The Start menu has appeared prone to crashing, and apps





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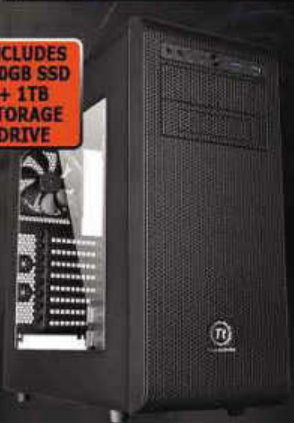
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are not working as well as they should. Computers are also taking longer to load. A software engineer asked Insiders to report their findings about the new updates, but it only led to a deluge of people complaining. At the last count, 1,045 people had responded and pretty much everyone had a problem.

"I updated yesterday and have had two problems," said a user. "1. My preferred monitor resolution is now longer available. I have an HP Compaq LA2006x with a preferred resolution of 1600 x 900. That is no longer an option under "Display Settings," closest I can come is 1400 x 900. Reinstalled the driver, which did not help. The graphics card is ATI Radeon HD 4200; when I check for an update it says the most updated driver is already installed. 2. Like some others, most of my apps no longer work (Windows Store, Calculator, Photo Gallery, Messaging, Alarms, Solitaire, etc). I tried sfc/scannow, no corrupt files found."

Once again, it underlined the folly of allowing automatic updates. It makes it harder to nip issues in the bud, potentially undermining confidence in the operating system. A fix has to be rolled out in the anticipation that everyone affected receives it. The hope is that doesn't make the problem worse. It's sure to cause a biting of nails on both sides of the fence, within the walls at Redmond and the homes and offices of the users. The idea is sound in principle, with auto updating meaning everyone is potentially brought up to speed at the same time, but it also means disaster can strike on a large scale.

## Happy Anniversary

That brings us to the next big update, which is looking to make its debut this summer. The so-called Anniversary Update is intended for PCs, tablets, phones, Xbox One, Microsoft HoloLens and the Internet of Things, and it's set to bring some major new features to the table. Among them will be Windows Ink, which claims to put "the power of Windows in the tip of your pen", letting you write on your device and use Maps, Edge and Office in a different way.

Cortana will be available before login, allowing you to play music, set reminders and scribble notes. And with Windows Hello, it will be possible to unlock a PC via a compatible phone, which should make it far more secure. Gamers will be able to benefit from DirectX 12 games and Xbox Live features, and there will a freebie on offer to entice upgraders: *Forza Motorsport 6: Apex*. Testers are already



## BOGOF Windows Phones

Microsoft is continuing to struggle in the mobile phone space. It has begun offering Lumia 950 and 950 XL smartphones on a buy-one-get-one-free deal in the US and Canada.

The initiative should boost the number of Windows 10 mobiles being used, but with just 2.3 million having been sold in the last quarter, it would appear that Microsoft has a lot of catching up to do with rivals.

giving the Anniversary Update the once over, and it will form part of the "two-or-three times-a-year" update plan. When it's finally available, it will become part of the recommended update that will install automatically on computers unless you take steps to stop it.

During these kinds of processes, choice is being taken away. It's similar to buying a CD from a shop (old fashioned, we know) and then having the store manager come round to your house and swap it for the next album while not allowing you access to the old one. All the songs you liked have gone, and the new ones have some duds among them that do very little for you. Worse, the new CD is scratched so it jumps about a bit. But the store assures you that it will replace that CD with a new one in due course as long as

you sit tight for long enough. Few would be happy with that, so it stands to reason that not many are happy with forced Windows updates either.

But it's something we may well have to live with. Jeremy Korst, general manager of Microsoft's Windows and Devices team, says there are users who want a simple, seamless way of staying up to date with the latest, most secure version of Windows, and that the current way of working enables them to achieve that. The rest of us just have to keep a keen eye out for what may be happening in the background – or switch to Linux or Mac OS X. At a time when other operating systems – notably Android – are making gains on Windows' overall market share, Microsoft really cannot afford to annoy too many people. **mm**





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# The Big Gaming Peripheral Guide

From mice and keyboards to headsets and more, we look at some performance peripherals that have caught our eye...



▲ Thermaltake Tt eSports Talon

► Qpad QH-90







**F**or as long as it's been possible, people have used computers for more than just serious work. Sure, plenty of users learned to code on Spectrums and Commodore 64s, but it's a safe bet that many people just used them to play *Pac-Man* or *Paperboy*. And as these games became more sophisticated and gamers began to demand better graphics and sound, more powerful hardware was needed. Thus gaming became one of the key forces driving progress in computer hardware.

There are, of course, loads of other reasons to own a powerful PC, but there's no doubt a lot of components and systems are aimed specifically at gamers. Most obviously graphics cards, processors and other internal hardware are marketed with a marketing spin, as are high-definition, quick-response monitors. But it doesn't stop there. Peripherals like mice, keyboards and headphones are also now created with gamers in mind, and the number of companies invested in this market is expanding all the time.

As with many gaming products, though, these aren't only suitable for gamers. They normally offer high-end design and features, and the very things that make them good for play also make them work well for more serious tasks. So whether you're shooting zombies in *Left 4 Dead* or shooting off emails in a web browser, many of the peripherals here should be of interest.

## Mice

If you've only ever used cheap, bog standard mice, it's hard to appreciate just how much different a gaming mouse can be. For a start, their physical designs are frequently more comfortable (although it's worth bearing in mind that many of them are right-handed only). They also tend to have more buttons than ordinary mice, which can be useful outside of games as well as within them.

More importantly, they usually have highly sensitive sensors, which allow for much greater levels of accuracy than you might otherwise be used to. Even if you're just word processing or filling out spreadsheets, this will help you to click on the things you want the first time you try and not the second or third. And in games, that means shooting the enemies, rather than the walls behind them.

“ The very things that make them good for play also make them work well for more serious tasks ”

Other features to look out for are DPI switches, which enable you to change the sensitivity on the fly; programmable buttons; profile buttons, so you can quickly change between your custom configurations; on-board storage for your profiles; specialist software for macros and fine tuning; and build quality designed to withstand years of long gaming sessions.

## Budget buy (£1 – £24)

If you're really on a tight budget, you can get a mouse with gaming features for less than £3. As you can no doubt guess, though, at this price it's going to be from an unnamed Chinese brand, which comes with all the risks and disadvantages you'd normally associate with such items. But at such a low price, it still might be worth consideration. For example, we found a decent-looking wireless gaming mouse at GearBest ([goo.gl/6256GY](http://goo.gl/6256GY)) for only £2.72 with free shipping. It has a maximum 2000dpi sensitivity, a four-level DPI switch, six buttons, on-board memory and 2.4GHz wireless with an operating distance of up to ten metres. It's also available in black or red. What you

➤ **Element Gaming Mouse Cobalt 120**







▲ GearBest Wireless Mouse



▲ Mad Catz R.A.T. Pro



▲ Razer Naga

probably don't get is high-quality configuration software or a decent warranty.

If you're willing to spend a bit more, then there are tons of non-brand gaming mice on Amazon and eBay for around a tenner. But if you're spending that much, then you might as well pay a bit more and get one from a company you've actually heard of. For example, you could pick up the Gigabyte M6900 for just £15 from Dabs.com ([goo.gl/z6TkIG](http://goo.gl/z6TkIG)). It offers three sensitivity levels up to 3200dpi, a DPI switch, a scrollwheel with left and right tilt, a total of seven buttons and a specially designed software tool. What we couldn't find was any mention of on-board storage, but if you're not taking your mouse away from your own PC, then that won't matter too much.

There are loads of other capable mice at this kind of price too, but a couple of notable ones are the Thermaltake Tt eSports Talon (£15 from CCL – [goo.gl/DZ6izi](http://goo.gl/DZ6izi)) and the Trust GXT 152 (£14.62 from Kikatek – [goo.gl/jx0EG5](http://goo.gl/jx0EG5)).

Also, check out the the Element Gaming Mouse Cobalt 120, which can be yours for a mere £8 (Ebuyer – [goo.gl/V5xgrn](http://goo.gl/V5xgrn)). This has all the features of a more expensive gaming mouse, like navigation buttons and a DPI switch, but it's far more affordable.

### Mid-range (£25 – £59.99)

This is the price range in which you'll find the majority of gaming mice from reputable manufacturers. At the cheaper end of the scale, you can get something like the Speedlink Kudos RS (£29 from CCL – [goo.gl/motUok](http://goo.gl/motUok)). This offers seven programmable buttons, a collection of weights that can be put inside the mouse, a scrollwheel with tilt, a DPI switch, a maximum sensitivity of 5700dpi, a profile switch and on-board storage that can save up to five profiles. Plus you get the necessary software to tweak its settings and get the most out of it.



▲ Gigabyte M6900

Also worth checking out at this sort of price are the SteelSeries Rival (£29 from Box.co.uk – [goo.gl/WKgZr](http://goo.gl/WKgZr)) and the Logitech G300s (£32, Ebuyer – [goo.gl/8hC9iM](http://goo.gl/8hC9iM)).

Climbing the price scale a bit (between £35 and £59), you'll find mice from all the big names, including gaming peripheral specialists like Razer, Roccat and SteelSeries (They also offer cheaper products, but they tend to be quite basic, missing features like navigation buttons and DPI switches.) You'll also find names like Corsair, Gigabyte and Logitech selling great mice at these kind of prices.

The Gigabyte M8000X can be found on Amazon for just over £40, which isn't bad for a mouse with a 5600dpi sensor, a weights system, a set of replacement feet, on-board storage, a tilting scrollwheel, a DPI switch and navigation buttons. Also, check out the odd-looking Mad Catz R.A.T. 5, which you can get from Box.co.uk for £45 ([goo.gl/tZRFBo](http://goo.gl/tZRFBo)), the ambidextrous SteelSeries Sensei Raw (£41, Box.co.uk – [goo.gl/aRSU6J](http://goo.gl/aRSU6J)) and anything from the other big names we've mentioned. At this kind of price, you really are spoilt for choice.

### Gamepads

Although keyboard and mouse is the traditional control system for PCs, controllers are becoming more useful for a number of reasons. For a start, they're supported more often in new games, and there are more console ports than ever before. And things like Steam's Big Picture mode and streaming devices show that many PC gamers want to play games while sitting on a sofa instead of a desk chair.

Our first recommendation is definitely the official Xbox 360 controller for PC, which you can currently get from Amazon ([goo.gl/nmF06q](http://goo.gl/nmF06q)) for £20. Not only does this provide guaranteed support for most modern games, it's also just a really good controller. There are plenty of other controllers worth considering, though, including ones that feature the same Xinput support as the Xbox controller. These third-party pads, however, usually have extra functionality, such as turbo button modes.

It would remiss to leave out the Steam Controller. Available directly from Steam for 40 quid ([goo.gl/iPNjJ](http://goo.gl/iPNjJ)), it's an innovative piece of kit, which uses dual trackpads instead of joysticks, and although the learning curve is steep, reviews have generally been positive. Definitely worth it if you're after something a little different.



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▲ Logitech G910 Orion

### Money is no object (£60 or more)

Although it's not necessary to spend this much on a gaming mouse, there are plenty of them that cost in excess of 60 quid. For example, you could buy the Mad Catz R.A.T. Pro X for around £150 ([goo.gl/A7aYnP](http://goo.gl/A7aYnP)), if you're feeling flush or if you just take your gaming that seriously. Like other R.A.T. mice, it looks like some kind of miniature robot, but it also offers some intriguing features, like three hot-swappable sensor units, a magnesium alloy chassis, and an analogue scrollwheel with adjustable tension and the ability to pivot. Plus you get the usual extras such as built-in memory, ten buttons, maximum 5000dpi sensitivity and so on. Is it worth 150 quid? Maybe, but other models in the R.A.T. range offer similar features for less.

If you want to keep your spending below £100, then there are plenty of other high-end mice to consider. The Razer Naga, for instance, can be found on Amazon for about £70 ([goo.gl/UfEjxR](http://goo.gl/UfEjxR) – £60 for the 2014 version). Designed for MMO players, it features an impressive 12 thumb buttons, as well as a DPI switch, 16,000dpi sensitivity, a tilting scrollwheel and fully customisable colours for the built-in LED lighting.

“ As you've probably noticed, cheaper keyboards tend to have a soft, springy feel to them ”

Also, worth checking out are the Logitech Proteus (£62 from Viking Direct – [goo.gl/eMFNZO](http://goo.gl/eMFNZO)) and the Roccat Kone XTD (£60, Scan.co.uk – [goo.gl/QJTbha](http://goo.gl/QJTbha)).

### Keyboards

As you likely know, there are two main types of keyboard: membrane and mechanical. If you buy a cheap keyboard designed for basic office tasks, then it's most likely a membrane model – or, more accurately, a full-travel membrane keyboard. Whether they use full-size keys or flat ones (also known as chiclet or island-style keys), the technology is essentially the same. Below the keys, there's a rubber or silicone membrane (hence the name), and under each key, there are domed areas. Press down on a key and you invert this dome, causing it to press down on a kind of circuit called a switch matrix. This then sends a signal to your computer that you've pressed a key and which one it is.

As you've probably noticed, cheaper keyboards tend to have a soft, springy feel to them, and this is why. They can still feel fine



▲ Gigabyte Aivia Osmium

to type on, but they can be error prone and slow, due to the way the circuit works.

That's one reason why a lot of gamers and other computer users prefer mechanical keyboards. These work in a much different way. Instead of a membrane under the keys, each individual key has a separate switch. If you've ever used one, you'll notice they often produce a satisfying clicking sound when pressed. They're also said to be more comfortable to use, causing less stress on your fingertips.

Ultimately, which one you go for depends on how much you're willing to spend, how much typing you plan to do and which kind of typing feel you actually prefer.

### Joysticks

Before the Nintendo Entertainment System and its ilk came along, the joystick was the dominant form of control system for video games. These days, though, they're generally only used by fans of flight simulators, but they're a lot more complicated than the simple one- or two-button sticks of the Amiga or Atari days, and their prices vary massively. A Thrustmaster HOTAS Warthog, for example, will set you back at least £258 (YoYoTech – [goo.gl/MaBu27](http://goo.gl/MaBu27)), but it's a very high-end device, featuring mostly metal construction and all manner of other goodies.

For those with more limited budgets, though, there's still plenty of choice. The Thrustmaster T.Flight HOTAS X, for example, costs just £32 from Scan ([goo.gl/DWbGK1](http://goo.gl/DWbGK1)), but it's still a highly rated stick, which will be perfect for anyone dipping their toes in the waters of flight sims.

There are plenty of other familiar names in this market, including Logitech, Speedlink and Saitek, so do shop around before making a purchase.





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▲ Logitech G19s



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## Mechanical Keyboards

### Budget buy (£1 – £59.99)

If you're not sure which type of keyboard to get, the good news is that for less than 60 quid, the decision is pretty much made for you. At this kind of price, mechanical keyboards are nearly impossible to get hold of.

Nearly but not quite. If you once again turn to GearBest, purveyor of cheap Chinese imports, then you'll find you can get a Motospeed Inflictor CK104 mechanical keyboard for around £38 ([goo.gl/k4ZwLO](http://goo.gl/k4ZwLO)). Available in a selection of different colours, it offers a variety of backlighting modes, blue switches, anti-ghosting and... well, that's pretty much it. Details are scant on the GearBest site, but there are some YouTube videos of the keyboard in action. From what we can tell, it doesn't really have any gaming features, other than some pretty lights, but it is a mechanical keyboard for less than £40, so maybe it's worth taking a risk on. However, we'd recommend spending more and getting something more reliable.

You might also find the Zalman ZM-K500 in your search for a new keyboard. Available for around £38 from places like Maplin and Dabs.com, it comes from a company that's well known in computing circles, mainly for its cooling products. Unfortunately, user reviews have been mixed. Some suggest it has poor reliability, with keys failing after a relatively short time. It sounds tempting, but we'd still suggest exercising caution before buying this keyboard.

### Mid-range (£60 – £99.99)

Once you reach this level of spending, you have a good chance of getting a decent mechanical keyboard from a reliable manufacturer. The Gigabyte Aivia Osmium, for example, can be bought for £65 from CCL ([goo.gl/gck3nb](http://goo.gl/gck3nb)), which is a bargain, considering you get Cherry MX Brown switches, backlit keys, a USB 3.0 port on the side, headphone and mic ports, anti-ghosting, support for 64 simultaneous keypresses, five macro keys, five on-board profiles, a volume wheel, a backlight adjustment wheel and the software you need to set it up. It's a few years old now, hence the low price, but it will still do the job perfectly well.

For the same price, you can get the Cooler Master Quick Fire TK from Box.co.uk ([goo.gl/CkCsVP](http://goo.gl/CkCsVP)), which also has Cherry MX Brown switches. It also offers backlighting, a detachable braided USB cable, N-key rollover and seven multimedia keys. Pay £5 more and you can change to Blue or Red switches, which is great if you know exactly which sort of keys you like most.

There are many more high-quality mechanical keyboards at this price, so here's a quick list of some notable ones: the Razer BlackWidow Tournament (£70, Currys – [goo.gl/8z6l1g](http://goo.gl/8z6l1g)), the Corsair Vengeance K65 (£75, Dabs.com – [goo.gl/HajXqw](http://goo.gl/HajXqw)) and the Thermaltake eSports Meka G-Unit (£67, Scan – [goo.gl/4RxiOo](http://goo.gl/4RxiOo)).

### Money is no object (£100 or more)

Although you can buy specialist keyboards for a few hundred quid, mainstream mechanical gaming models tend to top out at around £160. For that price, you can purchase a Logitech G910 (you can also find it for about £142 on Amazon – [goo.gl/uH8rF7](http://goo.gl/uH8rF7)), a keyboard that uses a relatively new type of mechanical switch designed by Logitech itself. Named Roma-G switches, they've been created from scratch with gaming in

## Steering Wheels

As with joysticks, the name Thrustmaster comes up a lot when looking at steering wheels for the PC, but Logitech, Speedlink, Trust and others crop up too. For just £30 (LambdaTek – [goo.gl/Mdbca0](http://goo.gl/Mdbca0)), you can get the Logic3 TopDrive FreeBird, which is a wireless steering wheel, complete with two pedals, adjustable steering sensitivity and force feedback. Plus it's compatible with PS2 and PS3 as well as PC. It looks very plasticky, but you can't really expect more at this kind of price. At the other end of the scale, you have things like the Logitech Driving Force G929 wheel and gearstick bundle, which comes in at £230 from Currys ([goo.gl/ZMtj63](http://goo.gl/ZMtj63)). With this you get a dual-motor force-feedback mechanism, helical gearing, stainless steel paddle shifter and pedals, 900° rotation so you can turn the wheel two and a half times, and an all-round more realistic driving experience.

Whatever you go for, try to take your chosen wheel for a spin, so to speak, before laying down any cash, because you obviously want the most realistic driving experience you can get for your cash.







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▲ Novatech headset

mind. Cherry switches, apparently, did not have this focus when they were originally designed.

Logitech's switches offer a shorter travel distance and a higher actuation point, and they're said to be 25% faster than other mechanical switches. Also, the spring and stem have been designed in such a way that more effective backlighting is possible.

That's not all you get for your money, though. As well as the usual sort of gaming features like nine programmable buttons, anti-ghosting and so on, the G910 is compatible with Logitech's Arx Control mobile app, which enables you to monitor your PC settings using your phone or tablet, as well providing system information and a second display for supported titles. It might be expensive, but clearly Logitech has tried to make it worth the cost.

Also, look out for the SteelSeries Apex M800 (£140, Box.co.uk – [goo.gl/ilgcbu](https://goo.gl/ilgcbu)) and the Roccat Ryos MK Pro MX (£120, PC World – [goo.gl/UrvFjK](https://goo.gl/UrvFjK)).

## Membrane Keyboards

### Budget buy (£0 – £39.99)

If you're not after mechanical keys, then it's much easier to find a gaming keyboard at a low price, usually stuffed with all kinds of features for gamers. The Sharkoon Shark Zone K30, for instance, can be yours for £27 from Novatech ([goo.gl/P05S4f](https://goo.gl/P05S4f)). That's a great price for a fully backlit keyboard with dedicated software, five micro keys, three profile buttons, a full-size numpad and more. You don't get dedicated media controls, but the Fn key does enable you to use the F keys for this purpose. At this kind of price, it's never going to match up to more high-end keyboards, but you do get a surprising amount of features for your money.

Increase your spending a bit more, and you'll be able to get a Speedlink Parthica Core for approximately £38 from CCL ([goo.gl/x8FWA2](https://goo.gl/x8FWA2)). This is a fairly hefty keyboard, and it's absolutely packed with features, like anti-ghosting, six-key rollover, a Windows key toggle, five macro buttons, ten multimedia keys, 128KB of internal memory, dedicated software, four levels of response time and a profile button. For the price, it's a great item, even if it doesn't match up to mechanical units.

Other budget buys that caught our eye include the Asus Cerberus (£30, Kikatek – [goo.gl/YDQMFO](https://goo.gl/YDQMFO)), the Roccat



▲ Element Headset Neon 250

Arvo Compact (£30, LambdaTek – [goo.gl/YNZ1l6](https://goo.gl/YNZ1l6)) and the Thermaltake Challenger Prime (£27, CCL – [goo.gl/St3aTI](https://goo.gl/St3aTI)).

### Mid-range (£40 – £79.99)

At this kind of price level, things open up a bit more, and we even start to find keyboards from premium peripheral brands like Razer and SteelSeries. Beginning with a cheaper item, though, the Genius GX Manticore (£45, Ballicom – [goo.gl/Tla1sT](https://goo.gl/Tla1sT)) is a decent buy. With its backlit keys, eight macro keys, three profile

“ If you're not after mechanical keys, then it's much easier to find a gaming keyboard at a low price ”

buttons, on-board memory, two USB ports, Windows key toggle, mechanical switch simulation and more, it offers a lot for your money. It's not without its problems, but it's good for the money. At the time of writing, however, there were only two in stock, with two more at CCL and a few at Amazon, so this model is probably on its way out.

Raise your budget a little, and your options increase hugely. Any of the following keyboards would be well worth checking out, because they all come with similar features, such as on-board memory, macro buttons, multimedia controls, backlighting, configuration software and so on: the Roccat ROC-12-902 Isku FX (£64, Amazon – [goo.gl/Ky9D5S](https://goo.gl/Ky9D5S)), the Razer DeathStalker Essential (£53, LambdaTek – [goo.gl/nQmiU7](https://goo.gl/nQmiU7)) and the SteelSeries Apex 300 (£57, Box.co.uk – [goo.gl/i2tcQe](https://goo.gl/i2tcQe)).

Any of these will do the job, but it's worth looking around as much as possible to find the keyboard with the right features for you.

### Money is no object (£80 or more)

At this kind of price, you could buy a mechanical keyboard, which are generally more highly regarded by gamers and typists alike.



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But each to their own, of course, and there are actually a fair few membrane-based keyboards that cost more £80, and as you'd expect for this kind of financial outlay, they come with all the premium features you'd expect.

Once again, Logitech provides one of the most noteworthy high-end examples – this time with its G19s gaming keyboard, which has an RRP of £180, with most sellers listing it at around £150. Currently, however, you can pick one up on Amazon for £109 ([goo.gl/yxC1P2](http://goo.gl/yxC1P2)), which makes it an intriguing prospect. It has all the usual kind of features you'd expect from a gaming keyboard, like programmable buttons, profile keys, multimedia controls and backlighting (fully customisable in this case), but none of this alone would justify such a high price for a non-mechanical product.

What might sway you, though, is the LCD screen that sits upright near the back of the keyboard. This full-colour screen, called the GamePanel, can display all kinds of information, like game statistics, system feedback, VoIP data, custom applets, images and even YouTube videos. Of course, such technology needs to be powered, which means you'll need a spare plug socket to use the G19s, which isn't ideal. It does, however, mean

“ If you've only ever used cheap, bog standard mice, it's hard to appreciate just how much different a gaming mouse can be ”

the two USB sockets it has are powered, which could be useful for things like external hard drives.

Another high-priced membrane keyboard that stands out is the Mad Catz S.T.R.I.K.E. 7, which comes in at a quite ludicrous £214 at CCL ([goo.gl/S7SHHJ](http://goo.gl/S7SHHJ)), and that's actually cheaper than most sellers. Like a lot of Mad Catz products, you get a huge amount of functionality, but most notably it has a detachable touchscreen LCD, active wrist rests and a detachable numpad. The amount of features this thing has could probably fill a whole page, but ultimately it's let down by its lack of mechanical keys and its high price.

## Headsets

Possibly more than any other peripheral, what makes a good gaming headset is extremely subjective. Audiophiles might well point to things like driver size or impedance values, but in our experience even cheaper headsets can sound decent, while premium brands aren't always as amazing as they're cracked up to be.

In general, though, you do get what you pay for. While some cheaper products might punch above their weight and more expensive alternatives might not live up to expectations, most of the time if you pay more, then you'll get better-quality headphones. This same logic applies also to headset microphones, with higher-quality products generally having more effective noise cancelling.

And as with anything, build quality varies massively. Since you'll probably be wearing a headset for extended periods of time, you want something that's going to be both comfortable and robust.

## Budget buy (£0 – £34.99)

Although you can get a headset for just £2.22 from DealsMachine ([goo.gl/frilfM](http://goo.gl/frilfM)), it's highly likely that this headset will be of very low quality. Of course, at such a low price, you wouldn't have much to lose if you did buy one. This seller, though, as you can guess, is based in China, so if your item does ever arrive, it'll probably take a long time to reach you.

For this reason, we'd recommend upping your expenditure a tad and looking at something like Novatech's own-brand gaming headset, which costs just £10 ([goo.gl/uPSyJZ](http://goo.gl/uPSyJZ)). This uses 3.5mm connections for both the mic and the headphones themselves. We haven't had one to test, so we can't comment on the sound quality, but a tenner is a small investment and, unlike cheap alternatives from overseas companies, you get peace of mind, knowing that you're buying from a UK firm.

If all this unbranded stuff is of no interest to you, then you might be happy to hear the name Turtle Beach. For £30, you can easily find the company's Earforce Recon 50P headset, which is available from many retailers, including Currys ([goo.gl/E0FKle](http://goo.gl/E0FKle)). This is a standard 3.5mm headset, with an in-line volume control. Unfortunately, customer reviews suggest it's particularly fragile, with some saying it broke within a matter of weeks. This isn't surprising, because at this kind of price, you'll find most headsets are made almost entirely out of plastic, which is often not strong

## Virtual Reality

As you are no doubt aware by now, there are lots of virtual reality headsets coming our way, with the HTC Vive and Oculus leading the charge for PCs, and Microsoft's augmented reality device, HoloLens, coming at some point too. But they're not the only names in the VR market. In fact, there are loads of other companies vying for a slice of the VR pie, many of which you can find at [www.virtual-reality-shop.co.uk](http://www.virtual-reality-shop.co.uk).

These might seem tempting, because they often cost considerably less than the Rift or the Vive, with the 3Glasses D2, for instance, costing just £265 (Gearbest – [goo.gl/peqi7a](http://goo.gl/peqi7a)). But it's unlikely that any of these devices is going to get the kind of support that the main players are going to, and they probably won't offer the same level of customer support either. We can't comment on the quality of the hardware without trying these other headsets, but for now, you're best off either saving up for a mainstream VR headset or waiting for their prices to come down.







▲ SteelSeries Siberia



▲ Thermaltake eSports Level 10

enough to last. On the plus side, most people seem to be happy with the sound quality, so if you're careful, this headset could still be a good buy.

Perhaps of more interest is the Element Gaming PC Headset Neon 250, available for just £24.99 from Ebuyer ([goo.gl/IzEbS6](http://goo.gl/IzEbS6)). This comes with USB headset comes with 3.5m cable, a retractable microphone and a reinforced headband. But its headline feature (other than the low price) is 7.1 virtual surround sound with built-in vibration – the kind of feature usually found on more expensive products.

Finally, just making it into this price bracket, we have the Mad Catz Tritton Trigger headset (£34.99, PC World – [goo.gl/dGMFWR](http://goo.gl/dGMFWR)), which has a 3.5mm connection and an in-line control module. What it also offers is better quality audio, larger earpieces and stronger build quality. It still can't compare with more expensive alternatives, but it's not a bad investment, if you handle it with care.

## Mid-range (£35 – £89.99)

As soon as you get over £35, a lot of familiar names will suddenly be in reach, whether it's the Corsair Raptor Hs30 (£35.50, Ebuyer – [goo.gl/GlmXBn](http://goo.gl/GlmXBn)), the Logitech G230 (£40, John Lewis – [goo.gl/2EUChr](http://goo.gl/2EUChr)), the Speedlink Xanthos (£36, Scan – [goo.gl/yMr7GD](http://goo.gl/yMr7GD)) or something else. These all have 3.5mm connections and in-line control modules, and although their quality will vary, they should all be perfectly adequate for gaming and media use, even if they don't match the fidelity of more expensive solutions.

For £50, you can afford the Razer Kraken USB Essential surround sound headset from Laptops Direct ([goo.gl/ZUTN9D](http://goo.gl/ZUTN9D)). As you'd expect from a Razer product, the sound quality is excellent, with the virtual surround sound being a particularly useful feature. The unidirectional, noise-cancelling microphone will also enhance your gaming experience. If we have any concerns, though, it's about the build quality. It might be a mid-range 'essential' product, but 50 quid is a still a lot to spend on a wholly plastic headset, and experience tells us that even the most fancy of plastic headsets are liable to snap one day, due to frequent bending when putting them on.

Unfortunately, plastic construction is abundant in the gaming headset market. Whether it's the SteelSeries Siberia 150 (£45,

Box.co.uk – [goo.gl/ehQ84z](http://goo.gl/ehQ84z)), the Corsair Void (£50, Scan – [goo.gl/KJRCzd](http://goo.gl/KJRCzd)) or one of countless other such sets, they're often characterised by great sound but potentially weak physical materials. Of course, if you're careful with your headphones, then you won't experience any problems. Also, there are some very affordable metal-reinforced headsets too, like the Element Gaming PC Headset Xenon 700 (£45, Ebuyer – [goo.gl/8E1YFk](http://goo.gl/8E1YFk)), which are definitely worth a look.

Headsets can cost several hundred pounds (as we'll see momentarily), but you can also get some high-end features and technology for around £70. The Qpad QH-90 Pro (£71, Amazon – [goo.gl/4G6AZq](http://goo.gl/4G6AZq)) is a good example of this, with its strong aluminium construction, detachable microphone, 55mm drivers and excellent sound quality. You'll also find names like Plantronics, Asus and more at this kind of price, so it's worth shopping around.

## Money is no object (£90 or more)

If you really wanted to, you could easily spend around £200 on a headset, with something like the SteelSeries Siberia P800 (£190, Box.co.uk – [goo.gl/q0Tj7Y](http://goo.gl/q0Tj7Y)). Undoubtedly, this is made more expensive because it's wireless, but you also get top-quality (although still plastic) construction, lag-free audio, two 20-hour lithium-ion batteries, Dolby technology and an excellent level of comfort.

That's a pretty hefty chunk of cash to drop on a headset for most people, though, and there are even more expensive alternatives, from companies like Audio Technica and Beyerdynamic. But unless you have money to burn, you don't have to spend this much to get great-quality audio. For £94 from Amazon ([goo.gl/AI9B56](http://goo.gl/AI9B56)), the Thermaltake eSports Level 10M gaming headset features an aluminium reinforced frame, a removable headphone cable that can be connected to either the left or right ear cup, a noise-cancelling microphone and an adjustable headband that can be locked into place. It's a few years old now, and there were only three in stock at time of writing, but it shows the kind of quality you can get for your money if look at older headsets.

Also worth checking out: the Sennheiser PC363D (£171, Amazon – [goo.gl/uXz6gy](http://goo.gl/uXz6gy)). [mm](http://mm)



# Top 10 Tips For Cortana

**Cortana is one of the biggest new features in Windows 10. Roland Waddilove shows how to make the most of this personal assistant**

## 1 Hey Cortana!

Cortana has some useful settings that can improve the way it works and the results it produces. Click Cortana on the Start menu or click in the search box on the taskbar. Click the Notebook icon just below the home button on the left, and a long list of topics, plus Settings, are displayed. Click each one and enable all the options.

In Settings, turn on Hey Cortana, and Cortana listens all the time. When you want information or to perform an action, just say "Hey, Cortana!", followed by whatever you want. You can choose to have Cortana respond to anyone or just you. If you select the 'To me' option, Cortana asks you to speak several sentences so it (she?) can learn to recognise your voice and distinguish it from other people's.

## 2 What's That Track?

If you listen to music while using your computer and want to know what track is currently playing, just ask Cortana. Click the Cortana app or the search box in the taskbar and click the music icon in the top-right corner. Cortana listens, and after a few seconds it displays the track title, artist and artwork.

## 3 Play Music

If you store music in the Music folder in the OneDrive folder, you can play any track simply by telling Cortana. Let's say you have an Ed Sheeran folder in the OneDrive Music folder, and in that subfolder is an MP3 of 'Thinking Out Loud'. You could say "Hey, Cortana! Play Thinking Out Loud." Cortana would start the Groove Music app, find the track and begin to play it.

## 4 Get Maps

When you need to look at a map, you could open the Maps app or simply say to your computer, "Hey Cortana! Show me a map of London." The maps are quite small because they're in the narrow Cortana pop-up, but you can then click a map to open it in the Maps app.

## 5 Get Travel Directions

If you're going on a trip, whether by public transport, car or on foot, ask Cortana for directions. Say something like "Show me directions to..." Sometimes this opens a web browser to show the directions via Bing, but other times it opens the Maps app to show the directions.

A variation on this is to ask what the traffic is like. Press Windows+C to wake up Cortana and say, "Show me the traffic to..." A route map is displayed in the Cortana window, along with a comment saying whether there's heavy or light traffic and how long the journey is expected to take.

## 6 Set Alarms

Cortana can ensure that you never miss another appointment, event or *Game of Thrones* episode because you were too engrossed in whatever you're doing on your computer. You can set alarms, then Cortana reminds you when they're due.

Press Windows+C to wake up Cortana, and say "Set an alarm for..." It recognises different ways of saying the time, so you can say things like 2pm, 7.30 or quarter past four. You can also set an alarm as a countdown timer. For example, say "Set alarm for 40 minutes," and the alarm will go off 40 minutes from now.

If you want to know what alarms are active, just say "Show alarms," and if you want to cancel an alarm, just say "Cancel alarm at..." followed by the time. It's all very natural, and you just say what you want like you were speaking to a real person. C



▲ Configure the settings and let Cortana listen all the time



▲ Ask Cortana what music is playing right now

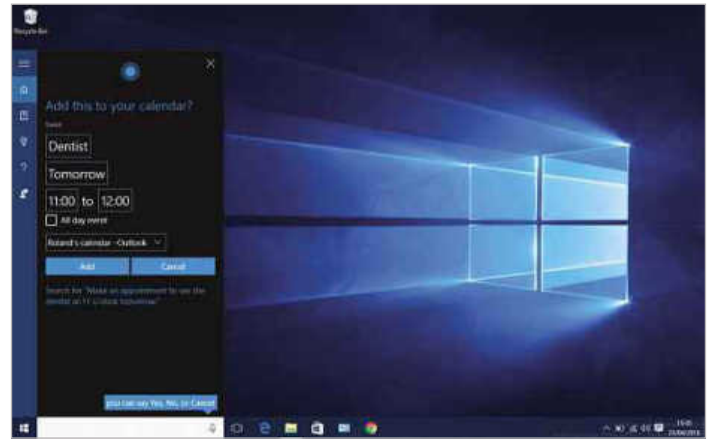


▲ When you need to see a map, just ask Cortana to show it to you





▲ What will the traffic be like today? Just ask Cortana



▲ It is easier to ask Cortana to create Calendar appointments than running the app

## 7 Reminders and appointments

There is no need to open the Calendar app when you want to make an appointment. Cortana can do that for you. Wake her up with "Hey, Cortana!" or press Windows+C and say "Create an appointment for 3.30pm tomorrow." An appointment has more than a time, it has a name, so Cortana asks you to say the title. It could be "Dentist" or "Lunch with Bob" and so on. Just say what it is.

Cortana is quite intelligent, and you can say things like "Create an all-day event on Friday, going to the seaside." Cortana will schedule the all-day trip to the beach as requested. The event is always displayed in the Cortana panel, so you can see it's correct, then you just confirm that it's to be set.

If there's insufficient information, Cortana asks you for each piece of information. For example, you can say "Create an appointment," and Cortana asks When? You reply with the date and time, then Cortana asks for the name of the appointment and so on.

Reminders are very similar to appointments and are made in almost exactly the same way. You can say "Remind me on Wednesday to..." Just say what you want to be reminded about. Cortana will ask for the time you want to be reminded. This information can be

included right from the start, so you can say "Remind me at nine o'clock tomorrow to pick up Sue on the way to work."

The most obvious problem with reminders and appointments is that you might not be sitting at your computer at the time, so you won't see the notice. Just install Cortana on your phone (Windows, Android and iOS). It syncs with your PC, and when you're out you'll see the notification on your mobile.

## 8 Store Notes

When you're working on your computer and need to remember something, just ask Cortana to save it as a note. Say "Take a note" and follow it up by speaking whatever it is you want to save. Cortana stores notes in OneNote, so if you want to read your notes, open the app and select the 'Quick notes' tab. The first few words are stored as the note title and the rest is stored as an audio file embedded within the note. Think about those first half dozen words and make them describe the content of the audio note. Double-click the audio file, and Groove Music opens and plays it.

## 9 Calculator And Units

Cortana can perform mathematical calculations and convert units from

one type to another, including currencies. For example, you can say "What is £50 in US dollars?" Cortana replies using the current exchange rate. Ask Cortana "What is 100 miles in km?" Quick as a flash, you'll hear the answer.

Cortana can also perform calculations involving addition, subtraction, multiplication and division. Just say what you want to know, such as "27.5 x 34.3" Not only does Cortana speak the answer, a calculator appears in the Cortana box so you can perform other calculations. You can ask more complicated questions like "What is 7.5% of 350?"

## 10 Get The Weather Forecast

You can ask a variety of questions about the weather and Cortana will supply the answers, saving you the bother of opening the Weather app. You can ask obvious questions like "What is the weather forecast for tomorrow," or any day of the week. You can even ask for the weather forecast for next week. Cortana speaks the weather and also displays a mini forecast with symbols indicating cloud or sun, maximum and minimum temperatures and so on.

Cortana also understands questions like "Will I need an umbrella tomorrow?" You sometimes get a definite yes or no, but Cortana is occasionally a bit more chatty and says things like "It is hard to know for sure; here is the forecast."

If you're planning a trip tomorrow or later in the week, just ask Cortana what the weather will be like in the place you're visiting. Say, "What is the weather forecast for Paris on Friday?" Just think how much work would be involved using the weather app or a website. Asking Cortana is so much easier. **mm**



▲ Cortana is good at arithmetic. Ask any calculation and see a calculator with the result



▲ Will you need an umbrella? Cortana can tell you the weather forecast



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# Your Letters

## Latest Versions

Ross Paton (letters MM1410) says "You choose to run Windows, you have to put up with the latest version."

Really?

Then, presumably, on July 28th. 2015, the day before Windows 10 was released, every single Windows user in the world was on Windows 8.1

What Ross has obviously never heard of is a little matter called 'User choice'.

In this, it would seem, he has much in common with Satya Nadella.

I'm actually quite looking forward to the day when the orders come whistling down the line "You WILL upgrade to Windows 10!"

My Linux PC will happily reply: "Microsoft? Nadella? Never heard of either of you. Now get lost!"

**John Todd**

## Win 10 Not Downloading Updates

I have just found a brilliant way of solving the annoying problem of Windows 10 unilaterally refusing to give you updates that it has found.

On both occasions that I have had this problem, (and spent hours screaming one or two choice words in the direction of California), and not finding a solution that works for me I have put the digits to the keyboard and started drafting a letter to the gurus that are yourselves (long may you and your forums reign as the supreme font of all PC knowledge and the saviour of all things microish).

On both occasions the mere hint of a missive heading in your direction has scared the living daylights out of the MS gremlins and the downloads begin – until next time! I have saved the e-mail in draft form just in case the Redmond lot send the big boys after me! Keep up the good work, you are a lifesaver 10 times over.

**Laurie Gutsell**

## Ransomware

I read the article in Issue 1409 very carefully, having twice been the victim of attacks. The first was two years ago, I had never heard of ransomware, and I was so shocked and apprehensive that I paid the £100 demanded to get my computer back, although I had no real idea of why I had been targeted.

The second time was about six months ago, and having become a bit more aware, I just turned my machine off overnight, and in the morning, the threat page had gone, and everything was back to normal. Which didn't stop me formatting the C drive and reinstalling the system image.

BUT, my question is this. Do some law enforcement agencies actually issue these ransomware notices, or are ALL these things just a scam?

**Douglas Johnston**

## Old Versions

In reply to Ross Paton ("Windows 10"), who wrote "Can you choose to run an older version of Android, Apple OS or even Linux?"

the answer is YES for Linux, usually YES for Android and NO for Apple.

Rather ruins the point of his letter!

**John**

# GET IN TOUCH...

### By email

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# Component Watch

**Buying a graphics card can be a minefield, but these deals will get you gaming and save you some dosh...**

Picking a graphics card is never easy, especially if you don't have an infinite budget. Even if you know the chipset you want, you still have to pick out a model and manufacturer from the crowd, and then face all the other considerations that come with that. To try and make it a little easier for you, this week we've looked at the mid-to-high end GeForce GTX 960 cards and picked out the best current deals.

**Deal 1: Zotac GeForce GTX 960 2GB**  
**RRP: £160 / Deal Price: £147**

Zotac's implementation of the GTX 960 chipset is clocked at 1127MHz, and comes with three DisplayPort outputs, HDMI 2.0 support and a 128-bit memory bus. Zotac make the cheapest version of the card on the market, and thanks to a deal on the cards right now they also throw in a free game (the eye-catching *Rise Of The Tomb Raider*, in this case) so if you want a powerful card at the best bargain possible, this is the one to go for. You'll save lots of money – well, a little less than 10% of the RRP – and the card's still better than anything cheaper.

**Where to get it:** Novatech ([bit.ly/1XX0ldE](http://bit.ly/1XX0ldE))



**Deal 2: Gigabyte GTX 960 OC 2GB**  
**RRP: £160 / Deal Price: £148**

This factory-overclocked version of the GTX 960 from Gigabyte is one of the better versions out there as it happens. The base clock speed is 1190MHz, an hike that rises further, to 1253MHz, in boost mode. You get DVI, DisplayPort, HDMI and DVI-D outputs for up to four-screen support. A WindForce dual-fan cooler makes it louder than most versions, admittedly, but you do get the improved heat dispersion and the overclock to make up for it – so if noise isn't a problem for you, this is a card worth getting.

**Where to get it:** Novatech ([bit.ly/1XX0ldE](http://bit.ly/1XX0ldE))



**Deal 3: Asus GTX 960 2GB**  
**RRP: £163 / Deal Price: £150**

Asus cards are well-known for being high quality so, while this isn't the cheapest card out there, this is worth considering – especially if you want the overclock, because it also runs at 1190/1253MHz, like the Gigabyte card. That said, it doesn't have a dual-fan cooler, so if you want a low-noise version and/or aren't worried about the card's temperature, this might be a better prospect since the prices are nigh-on identical.

**Where to get it:** Novatech ([bit.ly/21hfYEB](http://bit.ly/21hfYEB))



**Deal 4: EVGA GeForce GTX 960 Superclocked 2GB**  
**RRP: £170 / Deal Price: £156**

EVGA's model is superclocked to the fastest levels yet – a 1216MHz at base, and 1279MHz at turbo. It has a single-fan cooler, so it'll have to work pretty hard compared to the slower cards further down this list, but those extra few MHz might be important for getting an extra frame or two out of a game. The best for speed, if not price.

**Where to get it:** Scan ([bit.ly/1VWvFRz](http://bit.ly/1VWvFRz))



**Deal 5: Palit GeForce GTX 960 OC**  
**RRP: £164 / Deal Price: £158**

The Palit GTX 960 is overclocked slightly less than most (base 1165MHz / turbo 1228 MHz) so, when it's the most expensive card of the five, it's hard to recommend in any particular way. It's a viable option, though, so if it's the only one available (or you find it at an even better price) there's certainly no reason to give it a miss.

**Where to get it:** CCL ([bit.ly/1SSbVTE](http://bit.ly/1SSbVTE))







## Digital Divide “Holding Back” UK Economy

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# Kickstarter Campaign For iPhone Grip

### Camera grip brings DSLR functionality to smartphone

**H**ere's news of another Kickstarter campaign that you might just be interested in. miggo, a manufacturer of protective carrying solutions for digital cameras, has unveiled a fundraising campaign for a device that it's calling the Pictar.

Pictar is an ergonomically-advanced camera grip made for the iPhone that is designed to bring the familiar controls of a DSLR camera to Apple's smartphone. The Pictar ergonomic grip is compatible with most iPhone models and key features include five user-programmable wheels/buttons for full user control and access to a dedicated app featuring patented high-frequency dual tone sound control. The firm's thinks that this sound control is important as it can activate and control the camera without the need for Bluetooth, ultimately saving battery life.

Pictar's external controls will let iPhone users take selfies, zoom in and out via a zoom ring and a multi-state shutter button locks focus and exposure for easy tracking of a moving object.

You can find the link to back this over at [Kickstarter.com](http://Kickstarter.com) but it looks like the project is going to happen as it's already reached its target.





## CBI says half of firms falling behind

**T**he CBI has reported on a digital divide among businesses in the UK that it says is "holding back" the economy. The group, which represents businesses across the country, has carried out research on the adoption of digital technologies and found that, while 55% of 'pioneer' firms are adopting digital technologies and processes, others are falling behind.

The research also states that this divide has nothing to do with businesses not taking technology seriously – 94% of businesses felt that digital technology could revolutionise the business landscape, growth and job creation – but firms have cited security concerns and connectivity problems as possible barriers to adopting digital technologies.

The CBI wants companies to broaden the age and skills ranges on their boards to get firms up to speed.



Whatever you think about Facebook – about its tax arrangements, its use of its users' data and so on – it's hard to deny the sheer effectiveness of its business model. It's not only survived when other social networks have failed, it's continued to grow and innovate, expanding into areas that no one could have predicted it would.

Much of this consists of technology created by Facebook itself and strategies it has implemented, but it's also true that Facebook has made some canny acquisitions too over the years. And it often has an eye to the future when it's making these purchases.

Whatsapp, for example, was recently made free to all users, having previously cost a yearly (but very small) subscription. Of course, there's no doubt Facebook will benefit from this app in due course and that it forms part of a long-term plan.

So too does the Oculus Rift. Anyone entering the VR market is taking a risk at this stage, but is prepared to take that risk to play a part in this potentially massive market.

This is all exciting stuff, of course, but we shouldn't forget the more controversial aspects of this company, because it's going to play a major part in all our lives for some time to come.

*Anthony*

Editor

# New Flagship Tablet From HANNSpree

## Full HD display with octa-core performance

**T**he folks over at HANNSpree have been in contact as they have another device they'd like to run past you all. The HANNSpad Titan 2 is billed as the company's new flagship tablet, superseding the previous Titan device to offer more grunt.

The core specification of the Titan 2 is as follows: a 13.3" full HD screen with IPS display technology powered by an octa-core CPU, 16GB internal storage (plus the usual Micro SD expansion up to 32GB), 2GB DDR3 RAM, a dual camera setup with rear-facing 5MP and front-facing 2MP snappers. Behind the scenes, the Titan 2 is running by Android 5.1 out of the box.

With additional built-in GPS, users can turn it into a fully-functioning route and mapping device, while a Mini HDMI port means that the Titan 2 can be connected to a display for a

smart media center solution. The price on this is £199, so keep an eye out on your web travels – or you can type [www.hannspree.eu](http://www.hannspree.eu) into your browser for a closer look.





# Meanwhile... On The Internet...

**B**ing has, ever since it first appeared, played Johnny-come-lately second fiddle to the verb that is Google (nobody's 'Binging' anything... they're just searching using Bing). While it's not quite the punchline it once was, it's still the place people go when their browser isn't set up to automatically direct them Google's way. While that may sound a harsh assessment, a news story coming our way directly from Redmond leads us to believe that Microsoft knows it to be true.

Users of Microsoft's Cortana digital assistant may have noticed that, as of last week, should they have been employing one of the workarounds ([tinyurl.com/MMnet12a](http://tinyurl.com/MMnet12a)) that allowed it to search using another service, that the hack no longer works. That's because Microsoft is closing up its ecosystem to ensure that Cortana only works in conjunction with the Edge browser and Bing from now on. While browser searches can still be made via your search engine of choice, if you want to use Cortana, it's the Redmond way or no way.

As *The Verge* points out in its article on the matter ([tinyurl.com/MMnet12b](http://tinyurl.com/MMnet12b)), this is only the same as Google and Apple allow, as both restrict the changing of default search engine when using their respective voice assistants. However, for Microsoft – which is struggling to win back the market shares it once enjoyed in both areas, pre-Google, Chrome and iOS – it could backfire badly, and simply lead to an exodus away from Cortana. One presumes it's a calculated gamble; we'll see whether it pays off or not.

**Y**ou may remember that last week we spoke of how a US court has thrown out a ton of evidence that incriminated users of an highly illegal, highly unsavoury dark web site called Playpen on a technical point of law that dictated the warrant the FBI had used to get access to their computers was invalid as it was not within the jurisdiction of the magistrate that had given it ([tinyurl.com/MMnet12c](http://tinyurl.com/MMnet12c)). Well, unsurprisingly, the Feds don't appear to have been too happy with this... and thus have immediately put forward plans to change the law in question ([tinyurl.com/MMnet12d](http://tinyurl.com/MMnet12d)).

While that may seem a sensible move if it stops potential and very real paedophiles trading images online, more than a few organisations are keen to point out that there is a baby in the bathwater, and that the proposed changes would effectively give the FBI permission to hack any computer, anywhere in the USA ([tinyurl.com/MMnet12e](http://tinyurl.com/MMnet12e)), with little more than a sign-off from a judge ([tinyurl.com/MMnet12f](http://tinyurl.com/MMnet12f)).

The irony is that the Supreme Court's recommendation to change the law comes in the same week that congress unanimously passed a bill dictating the need for a warrant to access emails ([tinyurl.com/MMnet12g](http://tinyurl.com/MMnet12g)), which sets up the potential for another schism between the legal eagles who want easier access to potential evidence and the politicians who have to sell their policies to voters.

**R**eturning to the subject of Microsoft, *Micro Mart* used to run a popular little feature called Windows Crashing. For those who don't remember it, or more recent converts to the magazine, it was a place where we celebrated the appearance of the infamous Blue Screen Of Death in public places: advertising boards, cashpoints, timetable screens, quiz machines... you name it, our readers managed to snag pictures of Windows making it not work.

While that particular feature of ours may have slipped off to wherever it is that tech features retire to, it's good to know that the internet still enjoys watching Microsoft's flagship sink under its own logic. If it didn't, we probably wouldn't have come across the unfortunate case of Utah's KCCI 8 News – specifically its Meteorologist, Metinka Slater. Her attempt to inform the residents of the state on matters of weather was rudely interrupted by Windows' current *bête noire*, the Windows 10 upgrade prompt, which inconveniently appeared in the middle of her green screen at a most inopportune moment.

While Metinka managed to shrug of the matter in a very professional way, making light of the situation before the feed promptly switched (you can see it at [tinyurl.com/MMnet12h](http://tinyurl.com/MMnet12h)), whether or not she has since given in to Microsoft's prompts is, at present, unclear.

**W**hile we, of course, applaud the progress of technology, we also mourn the passing of certain things. For example, as the music industry's move to digital streaming and downloads has meant that we see less of the ostentatious sleeve art ([tinyurl.com/MMnet12i](http://tinyurl.com/MMnet12i)) that used to be a staple of shelves across the land ([tinyurl.com/MMnet12j](http://tinyurl.com/MMnet12j)), the rise of streaming services will eventually, you suspect, mean changes in sleeve art in the film world too.

For many nostalgia hounds, the zenith of that particular genre was to be found in video stores during the early-mid 80s. A time before computers took hold and before almost ubiquitous access to trailers and footage allowed films to be sold with a kind of visual hyperbole that just wouldn't fly these days. If you, like us, are one of those people, we'd like to point you in the direction of the Instagram account of the artist Canadian artist Steelburg ([tinyurl.com/MMnet12k](http://tinyurl.com/MMnet12k)), who is making a bit of a name for himself on social media by recreating the look and feel of 80s VHS covers using a variety of modern movies and TV series as his subject matter. Bought to our attention to by our friends at Mental Floss ([tinyurl.com/MMnet12l](http://tinyurl.com/MMnet12l)), which had a brief word wit the artist last week, it's not surprising that he's getting a lot of attention, as they certainly caught our eye.

## .AVWhy?

Videos For Your Eyes...  
Not Necessarily For Your Brain

We realise it's been a bit, erm... Nintendo-y in this corner of the magazine over the last few weeks, but bear with us on this one... Anyone who's ever played *Super Smash Bros.* will have a handle on just how frantic it can all get. Our very own John Moore once described the game as "just too quick, too bright, too dazzling a spectacle for anyone without an invisible alien friend helping them to deal with" ([tinyurl.com/MMnet12m](http://tinyurl.com/MMnet12m)) in his review for *Den Of Geek*, so he will be unsurprised, perhaps, to discover that it blends well with the frantic rhythmic patterns of free jazz ([tinyurl.com/MMnet12n](http://tinyurl.com/MMnet12n)).





## Caption Competition

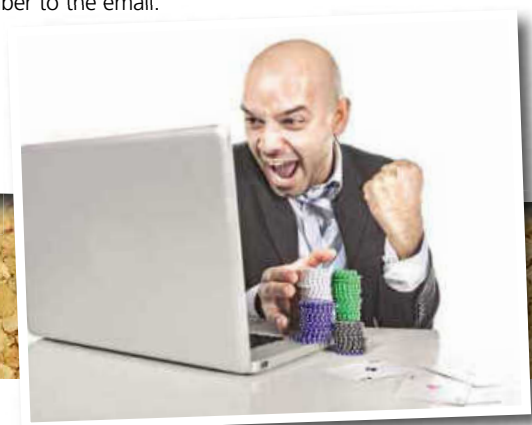


"Phone boxes make an unexpected comeback"

Let's see what you made of this image from issue 1410:

- JayCeeDee: "Celebrity Squares meets Blind Date!"
- doctoryorkie: "Phone battery longevity test. Spot the ringer."
- Dwynehugh: "As house prices continue to escalate, few can now afford the traditional home."
- Sawboman: "Don't blame them for being on the floor, they were babies when they were put on hold in the call centre queue."
- BullStuff: "...and I'm telling you, some guy named Schrödinger called me up and asked me to take part in an experiment!" - "Yeah, me too!" "And me!"
- wyliecoyoteuk: "Michael G Coney was right!"
- pesukarhu: "Not quite what they understood when the estate agent promised 'Live like Andy Warhol'."
- Thomas Turnbull: "You heard of battery chickens we now have battery workers."
- Ruud: "I'm the only one who's connected (with a cord)."
- Alan Masters: "The new Cube sequel suffers from extensive budget cuts."
- Chris Page: "Rumours of poor working conditions in telemarketing unfounded, says man working in tiny box."
- Sam Valsler: "Proof that one in four office workers still uses fax."
- Ed Winslet: "The BBC's new boxing coverage turns out to be a disappointment."

The winner this week is Jonathan Smith with "Phone boxes make an unexpected comeback." If you have a caption for the picture below, head to the 'Other Stuff' section of our forum ([forum.micromart.co.uk](http://forum.micromart.co.uk)), or email us your funnies via [caption@micromart.co.uk](mailto:caption@micromart.co.uk), remembering to add the issue number to the email.



# Kent Police Fined Over Data Breach

## Phone data upload lands Police in trouble

The Information Commissioner's Office has fined Kent Police £80,000 after it was reported that officers had given the contents of an alleged victim's mobile phone in a domestic abuse case to the suspect's solicitor.

It transpires that the phone, which contained video

evidence in support of the victim's case, was given to the solicitor in error ahead of the misconduct hearing, with the solicitor then disclosing that content to his client.

The fine was handed out in light of the insufficient security procedures that were put in place to avoid such a mishap.

# Dropbox Drops Windows XP Support

## Done, done, done... Another one bites the dust

File sharing site Dropbox has written in a help page on its site that it is going to end support for Windows XP within a couple of months. On June 26th "the Dropbox desktop app for Windows XP will no longer be available for download on [dropbox.com](http://dropbox.com)," users were told, while "signing in to an existing account or creating a new account will also no longer be possible on Windows XP".

The next stage in the process of Dropbox trying to push

people towards more recent versions of Windows is that on August 29th the desktop app will no longer support Windows XP at all. Any Windows XP users will be automatically signed out of any Dropbox accounts and will have to use Windows Vista or later to sign back in.

In terms of the stored content, all will remain safe. Presumably, more and more online services will have to take this stance on Windows XP in the foreseeable future as security and performance are paramount.



## Snippets!

### Android Device Vulns

The latest annual Android security report from Google has revealed that nearly 30% of all active Android devices are not supported by its security updates. Any devices running on a version of Android earlier than 4.4.4 do not receive security updates, so Google is quite understandably calling on users to update to the most up-to-date version of Android. Consider yourselves told.

### A Robotic Future?

Good grief. If the results coming out of research on behalf of the FutureFest event are to be believed, it's time to worry. According to a study of over 1,000 adults, a quarter of young people aged 18-34 said that they would happily date a robot as long as it looked like a human. Surely these can't have been genuine responses?

Also, half of those surveyed who already used contactless bank cards said that they would be happy to have microchips implanted in their skin to open doors or log on at work.

FutureFest 2015, which is sponsored by innovation foundation Nesta, is in September. Get more info at [www.futurefest.org](http://www.futurefest.org)

### Spanish Spy

This one may be a little hard to believe, but we assure you that it is oh-so-sadly true. Manufactured in Spain, the Smarttress smart mattress promises to help anyone suspecting their significant other of infidelity to confirm their suspicions through the use of connected technology. The mattress uses various sensors that pick up on movement, so that the owner will know that something is not quite right when they're away from home.

Quite ridiculous, of course, but all very real. How dreadful.

# Average Web Page As Big As Doom

### Big pics are to blame

A software engineer has worked out that the size of the average web page is more-or-less the same size as the original version of classic scary shooter, *Doom*. Stats at website HTTP Archive ([httparchive.org](http://httparchive.org)) show that the average web page is around 2.3MB these days – just shy of the installer for the classic FPS.

The reason behind the ever expanding size, we're told, is the increased use of larger images, while script code and video account for other larger chunks of that 2.3MB figure. Ronan Cremin warned in a blog post that this was symptomatic of the problem of web bloat: "Recall that *Doom* is a multi-level first person shooter that ships with an advanced 3D rendering engine and multiple levels, each comprised of maps, sprites and sound effects.

By comparison, 2016's web struggles to deliver a page of web content in the same size."

On the other side of the coin, Cremin also writes that the top ten websites have managed to reduce their average page size, so it's not all bad news.



▲ Does anyone not like Doom?

# Bangladesh Bank Hack Down To Bad Security

### Second-hand routers to blame

February's hack into the Bangladesh Central Bank's systems would have been an easy day's work for the perpetrators, as the bank had really poor security systems in place.

Reuters has reported that there was no firewall and that the bank used secondhand routers to connect to global networks. The news agency also quoted a forensic investigator as saying that

better hardware would have made the hack, in which \$81m was stolen, far more difficult to pull off. As for using cheap routers, this also meant that little network data was collected to help in the search for the hackers.

It bears remembering that this is a country's central bank that we're writing about here. Proof, if ever it was needed, that you need to spend money to save money (or at least keep your money safe).



# EE Looks Towards A 4G Future

**Also bringing customer services back to UK**

**S**tinging criticism for mobile firm EE has led to some big changes, the most notable of which is surely the relocation of its customer services from overseas call centres to the UK and Ireland.

Remember last year when EE was fined £1m for its poor handling of customer complaints? Well now it's decided to be all proactive to make things better. Bringing service centres back to our shores by the end of the year is probably a good step towards achieving that. It will also provide a bit of a boost for the economy, as it will mean the creation of 600 jobs.

Apart from its service improvement promise, EE is also planning on bringing 4G to 95% of the UK by 2020. Currently, EE's 4G service covers 60% of UK landmass and it's planning on achieving its target by focusing on 4G 'notspots'.



# Trump Tweet Leads To Arrest

**Bomb threat lands man in court**

**A**s the presidential election campaign continues across the pond, one man's ire over The Donald's ongoing popularity has led to his arrest.

Sean Morkys tweet, posted while Donald Trump was speaking to an audience in Connecticut, wondered "Is someone going to bomb the Trump rally or am I going to have to?" He then also tweeted to

a friend that his family should leave the rally so that they wouldn't be hurt. His posts were, unsurprisingly, picked up by the US Secret Service who then tipped off the Police.

Morkys was later released on bail, but he now faces a date on court on May 4th. Passions are clearly running high over the campaign in the States, but nobody can defend the posting of things like this.

# FBI Paid Over \$1m For iPhone Hack?

**Blimey**

**C**omments from FBI director James Comey regarding the money the agency paid for hacking into the iPhone that was used in the San Bernardino attack have raised eyebrows.

Responding to a question posed at a security event in London, Comey reportedly told delegates that he considered the cost to be worth it, the money paid was "A lot. More than I will make in the remainder of this job, which is seven years and four months for sure."

Given that his annual salary is over \$183,000, that's led to an estimation of around \$1.3m – and would be quite the

fee. Although, in the FBI and government's eyes, probably not all that much in the grand scheme of things.

Remember when John McAfee promised to do the job for free? We wonder if the FBI ever had a chat with him? Could have saved themselves a few bob there.



# E-sport Stars Arrested

**Match fixing scandal lands several in trouble**

**N**ews has emerged that a couple of professional gamers, who are masters of strategy title *StarCraft 2*, have been arrested and charged with match-fixing offences.

The investigation into match fixing ensnared more as eight individuals were indicted and arrested, including programmers and financial backers who were charged with receiving

tens of thousands of dollars to manipulate games. As for the two big gamers that were charged (one of whom is a multiple tournament champion), they stand accused of throwing matches over the past 12 months.

The South Korean prosecution service in this case has also said that e-sports match-fixing is happening on a "large scale". Troubling.



## BenQ BL2205PT

Great ergonomics and an even better price

### DETAILS

- Price: £105
- Manufacturer: BenQ
- Website: [goo.gl/ILo1QW](http://goo.gl/ILo1QW)
- Requirements: DisplayPort, DVI or VGA output

The BenQ BL business range of monitors is widely accepted as one of the better series for CAD users, designers and those who sit in front of a screen for long stretches of the working day. It offers a good mix of technology, ergonomics and quality, so we're interested to see how one of the company's newest model, the BL2205PT, fits into the grand scheme of things.

The BL2205PT is a 21.5" TN LED backlit screen with a maximum resolution of 1920 x 1080, a dynamic contrast ratio of 20,000,000:1 and decent viewing angles of 170° horizontal and 160° vertical.

Connectivity is adequate, with DisplayPort, DVI and VGA, but there's no HDMI, which seems a little of an odd choice for a business-class monitor. However, as we said, the connectivity is more than enough for most office settings.

The BL2205PT offers the low blue light levels and other special screen modes, alongside an anti-glare screen coating and flicker free technology. Of course the ergonomics don't stop with the screen technology. Since this is a business model, the BL2205PT can be moved through a variety of angles – enough at least to



▲ Ergonomically, the BenQ BL2205PT is a great monitor



▲ Connectivity is okay, but the price makes up for any loss

“ The display is quite sharp considering it's not an IPS screen ”

keep the local health and safety office happy.

With a forward and back tilt of -5° and 2° respectively, a 45° swivel, portrait and landscapes modes, and an adjustable height from 110mm to the base of the stand, there's plenty to help

you this screen set up.

The BL2205PT is also VESA wall mountable.

It's actually not a bad monitor for the average workstation. Usually you get some pretty dire quality at this sort of price, but with the BL2205PT, not only are there

good ergonomics at work, but it's also clear, and uncluttered.

The screen quality is good too. It's admittedly not quite up to the same level as the more expensive monitors in the BL-range, but it's certainly good enough for the average worker. The colours are reasonable, and the display is quite sharp considering it's not an IPS screen.

The biggest lure, though, is the cost. Whereas a lot of ergonomically designed business-class monitors can hit £200 or even £300 and beyond, the BenQ BL2205PT comes in at very reasonable £105, or slightly lower with free shipping if you shop around.

So while it's not the latest and most impressive gaming-spec monitor available, the BL2205PT is an excellent choice for those who need to comply with H&S while still having a good-quality monitor at a good price.

**mm David Hayward**

**A decent enough business class monitor**





# CorelDraw X8

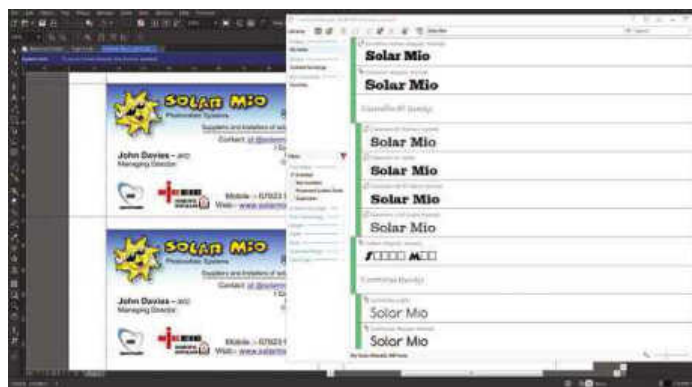
Joe Lavery looks at the latest version of Corel's premier graphics suite

## DETAILS

- Price: £529.00 subscription, £179.40 (a year)
- Manufacturer: Corel Corp.
- Website: [www.corel.com](http://www.corel.com)
- Requirements: Windows 7 or later, Intel Core i3 / AMD Athlon 64, 2GB RAM, 1GB disk space

Here we have version 8X of the CorelDraw Suite, bristling with new features and a few tweaks for the old ones. If you're familiar with the product, you'll already know it contains a lot more than the illustration program that forms the core part of the package, because you also get Corel Photo-Paint, Corel Website Creator, Corel Capture, Corel Font Manager and more. The company have now made purchasing the product more flexible. Naturally, you can still buy it with a one-off payment, but alternatively you can start a 365-day subscription for £14.95 a month. At a total outlay of £179.40, it's considerably cheaper than upgrading.

I accept that many people don't like change, yet I feel one of the first new features was badly needed. It's the ability to fully personalise the interface, effectively creating your own workspace, from the size of the icons and toolbars, to the background colour of the desktop. You can even change what tools will be displayed and change the overall colour scheme to make the GI look more like an Adobe product. Clearly the designers have realised that users have different needs and aptitudes, and these new customisation options allow



▲ Sort and preview your fonts with the new Font Manager



▲ The Corel interface is now fully customisable

you to set up your workspace for the task in hand.

Version 8X now supports 4K monitors and allows you to spread the interface across multiple screens. It also supports Windows 10 and with that its touchscreen interaction – assuming of course that you have a touchscreen system. You can also use it with any Windows Real-Time Stylus pen-compatible tablets.

I'm pleased to see that Corel has dumped the old font navigator and introduced a new Font Manager. This is a much better program, in which you can browse the fonts both on your system and those provide online by Corel. You can install or uninstall fonts, create collections and type in your own text to get a preview of each font. Corel has done a similar

makeover to the font list dialogue, which now works in tandem with the Font Manager, displaying any highlighted text in each font as the mouse pointer passes over it.

In previous versions, it was far too easy to grab objects you didn't want to, particularly if you were working with objects laid one on top of the other. Now you can lock individual objects within a layer and carry on working, in the knowledge that everything hidden will stay where you put it. The only way to do this before was to use lots of layers and lock off the ones you'd finished with.

Corel Photo-Paint has also been updated with the same interface enhancements as Draw and a few new tools of its own. The first of these, the Healing Clone Tool, when compared to

the Photoshop version, is a poor imitation, I'm afraid. It produces quite obvious blurring and is cumbersome to use; even on my i5 machine the cursor trails well behind as it tries to clone an area in real time. It's easier to use the standard clone tool. In contrast, the red eye removal tool works much better than the Photoshop one, which is decidedly a hit and miss affair. I see the Adjustment menu has also had some work, particularly the Perspective Distortion and Gaussian Blur tools, which work a lot better and are quicker than they were previously.

Finally another new feature introduced to both Draw and Photo-Paint is the Get More docker (not a burly welder from Tyneside). It's basically a web interface for downloading applications, plug-ins, and extensions, designed to expand the overall scope of the product. Some of these, like the Corel Website Creator, are free; others like AfterShot Pro have to be paid for.

As usual, if you'd like to see what Corel has on offer, you can download a fully working version from the company's website. You'll also find some great video tutorials to get you started.

**mm Joe Lavery**

**A genuinely worthwhile update**





# Dell Inspiron 11 3000 Series

Dell decides to take on HP's Stream 11 with a new affordable laptop

## DETAILS

- Price: £179
- Manufacturer: Dell
- Website: [www.dell.co.uk](http://www.dell.co.uk)
- Model: Inspiron 11-3162

Not long ago, Atom-based laptops were relentlessly awful, as the makers entirely focused on lowering the price and performance to implausibly low levels. The Dell Inspiron 11 3000 series, however, demonstrates that you can have a low price and enough performance to actually do some work – as well as offering great portability.

But being realistic, this isn't a gaming platform, and you're operating rather close to the edge when it comes to more demanding applications. At this system's heart is a 1.6GHz Intel Celeron N3050 that has just two cores and no Hyper-Threading, and it's only party trick is an occasional sprint to 2.16GHz.

When I first started using this machine, the N3050 really took a beating, because along with



“ With default storage so tight, this system probably isn't ideal for students ”

### Model: Inspiron 11 3000 Series

Processor: Intel Celeron N3050 1.6GHz. Boost to 2.6GHz

Screen: 11.6" 1366 x 768 pixels.

Graphics: Intel HD graphics.

Storage: 32GB eMMC.

Memory: 2GB.

Wireless networking: Wi-fi 802.11a/c, Bluetooth

Operating system: Windows 10 (64 bit).

Camera: Widescreen HD 720P webcam with digital microphone (front-facing).

Ports: 1x USB 3.0, 1x USB 2.0, 1x audio jack, 1x Kensington lock, 1x DC-In, 1x HDMI, 1x micro-SD card

Dimensions: H1.845 x W29.2 x D19.6cm.

Weight: 1.18kg.

Accessories included: AC adaptor, user guide/

me trying to use it, Windows 10 was trying to upgrade in the background.

That gave the impression that the N3050 and 2GB of RAM wasn't nearly enough power for Windows 10, but that wasn't the case.

Once the seemingly endless upgrade cycle completed, the machine entirely transformed in terms of responsiveness and therefore its usefulness. That's important, because in almost every other respect, the Inspiron 11 3000 series is acceptably specified, and in a few places it's actually rather good.

The screen, for example, might only be 11", has 1366 x 768 resolution, but it's really sharp, and the colours are vibrant and saturated. It uses TN display technology, so you need to have it at the optimal angle, but once there, it looks great unless you're outdoors in bright sunlight.

The keyboard, by necessity, is small, and it uses membrane technology, but it works well enough to type on for short periods. I wouldn't want to key a big dissertation on it, but for note taking and emails it's more than adequate.

Those wanting to type more could easily add a full-sized mechanical keyboard using one of the two USB ports, and with a HDMI output you could also connect a bigger screen too.

The only significant place that the build-to-a-price mentality





rears its uglier profile is in the amount of storage. In the review version, we had just 32GB of eMMC flash storage. That capacity leaves just 8.5GB of available space for the user once Windows 10 has been accounted for, and each new patch and update Microsoft releases erodes this further.

That there is any space left is testimony to some restraint by both Dell and Microsoft, who only preinstalled a few superfluous items on here, like *Candy Crush Soda*.

For those who want more productive tools, Dell did at

least include a micro-SD slot, so you can expand it a little using a micro-SHDC or micro-SDXC card. On any system that would be a welcome feature, but on this system it's an absolute necessity, especially when the next major upgrade to Windows 10 comes along.

Alternatively, you could use an external drive, and because one of the USB ports is USB 3.0, that would get you better performance than the USB 2.0 connected card reader slot.

In my testing, the best I could get out of the micro-SD slot was 28.5MB/s, whereas from the

USB 3.0 port using a Lexar S45 I managed 135MB/s – close to the 150MB/s performance of the internal eMMC.

In the USA, Dell sells this machine with a 128GB SSD or 500GB physical hard drive, a better quad-core CPU and 4GB of RAM. Hopefully those versions will make it to the UK eventually.

Impatient people intent on custom upgrades will be unsurprised to hear that it requires you to completely dismantle the machine to achieve – something I expect would void your warranty. Those keen enough can upgrade the RAM and storage using standard parts – or so the service manual suggests.

While you can't easily swap the battery, its life is decent and substantially better than I was expecting. Whereas most cheap laptops can only manage three or four hours even on light duties, the Inspiron 11 3000 managed more than seven on a regular basis. And it can charge entirely from flat in about two hours, should you need a quick turnaround.

With default storage so tight, this system probably isn't ideal for students, but for anyone who wants something cheap and cheerful to surf the web and chat online, it's practically ideal.

And while this product doesn't offer hardware options in the UK, at least it's available in three colours: Bali Blue, Alpine White and Tango Red.

But the real challenge for the Inspiron 11 3000 series is that currently it costs £30 more than the HP Stream 11, which has an almost identical spec.

**mm Mark Pickavance**

### A Dell alternative to the HP Stream 11





# Archos PC Stick

A new palm-sized Windows 10 PC

## DETAILS

- Price: ~£85
- Manufacturer: Archos
- Website: [goo.gl/U4lfhy](http://goo.gl/U4lfhy)
- Requirements: Windows/Microsoft account, spare HDMI port, keyboard and mouse

Last year, for a while, the media couldn't get enough of the Intel Compute Stick. This small device connected to the HDMI port of a monitor or TV and booted into a fully working copy of Windows 8.1.

Since then, there have been a number of contenders, each offering a slight advantage in terms of performance, ports available and so on, but the furore has calmed a little since then. Until now, of course.

The latest Windows on a stick to be released is the Archos PC Stick, a device that measures just 113 x 37.6 x 18mm and weighs only 60g, and it's effectively a handheld Windows 10 PC.

Powering the PC Stick is a 1.33GHz Intel Atom Z3735F quad-core processor, a 311MHz Intel HD GPU with a burst frequency of 646MHz, 2GB of memory, 32GB of eMMC storage and Windows 10 32-bit Home Edition.

Connectivity consists of 802.11n wi-fi, Bluetooth 4.0, a full-sized USB 2.0 port, a micro-USB port, 5V power, power button and a micro-SD card slot for up to 64GB cards. Naturally, removing the lid from one end of the stick will reveal the HDMI port that plugs into the monitor or TV.



▲ For under £100, it's a great Windows PC

The PC Stick itself comes in a light metallic-blue plastic cover. It's lightweight enough to not put too much stress on the HDMI input of the display you're plugging into, but attaching other USB cables to it

*The Witcher 3* at full HD resolutions, it's certainly more than enough for everyday PC duties. Word processing and other productivity works well; even some mild photo and video editing are acceptable provided



▲ It has its limitations, but for most users it'll suffice

possible, as is watching something from Netflix, BBC iPlayer and the like.

The Archos PC Stick is a great little device. It's slightly more powerful than the other models we've looked at and, better still, the price is around £85.

Considering you're getting a Windows PC for less than a hundred quid, the Archos PC Stick is a pretty good deal.

**mm David Hayward**

“ It's slightly more powerful than the other models we've looked at ”

can cause a bit of a problem if they're not long enough and add extra weight.

There are plenty of vent holes on both faces as well as the sides to help cool it down. Thankfully, though, the Archos PC Stick doesn't get too hot, even after being powered up for some time.

While the combination of the Z3735F and 2GB of memory isn't going to enable you to play

you don't try to push the processor too much.

Gaming is limited to very lightweight stuff; you could probably get away with CS:GO or something on very low graphical settings. We had it running as a retro console and home computer, emulating the Spectrum, Sega Mega Drive and so on.

It also works magnificently as a media centre. Full HD video is

**A reasonably powered, handy Windows PC on a stick**





# Gigabyte P35X v5

A gaming laptop with some stunning features

## DETAILS

- Price: £1,799.99
- Manufacturer: Gigabyte
- Website: [goo.gl/KRt8XZ](http://goo.gl/KRt8XZ)
- Requirements: Windows/Microsoft account, deep pockets

The Gigabyte P-series of gaming laptops are pretty impressive. We've seen a few of them in recent years, and with each new version the bar is set a little higher.

This time around, we have the P35X v5. This particular 15.6" laptop boasts a sixth-generation 3.5GHz Intel i7-6700HQ processor, 16GB of DDR4 memory, a 128GB Samsung M.2 SSD with a copy of Windows 10 64-bit Home Edition preinstalled, and a further 1TB 2.5" hard drive.

Graphics come courtesy of an Nvidia GTX 980M with an astonishing 8GB of memory, which helps drive the 15.6" UHD 3840 x 2160 IPS LCD screen. And in terms of connectivity, there are three USB 3.0 ports, a single USB 3.1 Type-C port, HDMI, VGA, mini-DisplayPort, gigabit Ethernet, a DVD drive, and an SD card reader. It also features 802.11n wi-fi, Bluetooth 4.1 and a HD webcam included.

The design of the P35X v5 is very much a Gigabyte standard, with a modern mix of matte-black plastic with a splash of orange colouring throughout. It has a nicely spaced backlit keyboard set in a slightly recessed area, with the large touchpad and button strip below. While good, though, the design



▲ The Gigabyte P35X v5 is an impressive gaming laptop



▲ 8GB of graphics memory! That's just huge!

does feel a little bland, especially if you stand it next to some of the current gaming laptops from Asus.

It is, however, remarkably slim, measuring just 20.9mm thick, and at 2.4kg it's not too difficult to carry around either. The power brick is a hefty thing to move around, though, but that's expected to some degree, considering the specification.

Booting into Windows took around ten seconds, and the P35X v5 managed to score 9,546 3DMark 11. In real-world terms, this meant *The Witcher 3* at high quality in the full resolution had an average frame-rate of around 45, while *Star Wars: Battlefront* at the same resolution in ultra settings managed 48fps, and *Fallout 4*

on high settings never dipped too much below 60fps.

The quality of the display is very good too. The colours are good, and this 4K screen performs remarkably well when displaying games and video.

Battery life while gaming lasted just short of a couple of hours from a full charge. Using it for everyday tasks and watching a video, we squeezed a tad over three hours out of it before we needed to plug it back in again. On the whole, that's not too bad since we're talking about a laptop that could put most gaming desktops to shame.

Of course, this level of performance doesn't come cheap. The £1,800 price may seem a little steep for most users, but considering the powerful graphics and performance on offer, you can be forgiven for thinking of splashing out on it.

We really like the Gigabyte P35X v5. It's a wonderfully compact yet extremely powerful laptop, and although it's a little pricey, it's worth every penny.

**mm David Hayward**

**Excellent performance and specs but expensive**





# Archos 50e Helium

A sub-£100 phone with plenty to offer

## DETAILS

- Price: ~£95
- Manufacturer: Archos
- Website: [goo.gl/tk4sXL](http://goo.gl/tk4sXL)
- Requirements: Google account, SIM(s)

There are numerous entry-level smartphones available at the moment, but finding one that manages to offer close to top-of-the-range features at a decent price can be quite difficult. Archos, however, might have what you're looking for right here.

The 50e Helium is a new entry-level device with a 5" 1280 x 720 IPS screen, a 1.1GHz Qualcomm MSM8909 quad-core processor, an Adreno 304 400MHz GPU, 1GB of LPDDR3 RAM, 8GB of storage and Android 5.1.1 Lollipop.

In addition to that little lot, Archos has also squeezed into the thin frame of the 50e Helium a pair of micro-SIMs, 4G, 3G, NFC, Bluetooth, an 8MP rear camera, a 5MP front camera and micro-USB. The 2100mAh battery is similarly good as well, lasting a couple of days with light use, and an excellent five or so hours when playing games, watching videos, browsing and so on.

The build quality is decent all-round. It's plastic throughout, but it doesn't feel cheaply made or lacking in any way. It has a good weight too at 150g, and it's only 8.5mm thick.



▲ The Archos 50e Helium is a good entry-level phone

The 8MP camera is certainly good enough for most average users, but those who are used to higher-spec Apple and Samsung models will undoubtedly be left wanting more.

Android 5.1.1 runs perfectly well on the 5e

Helium. The response of the screen is good, with very little lag, and the combination of Qualcomm CPU and Adreno GPU do a good job of keeping the performance up to scratch too. Our CPU-killing *Bloons Tower Defence 5* test ran

well, but there's only so much a sub-£100 phone can handle before the cracks begin to show.

There's little of the Archos footprint in Lollipop. Other than a few media apps and a collection of games, Archos has left the OS as vanilla as possible. One good element included here is the Archos version of Android Adaptive Storage, called Archos Fusion Storage. Fusion Storage essentially allows you to extend your internal storage with a micro-SD card, combining the two. The advantage is you don't manually have to move apps between the two, so by adding a 64GB micro-SD card, along with the 8GB internal storage, you'll have 72GB of total storage available.

The Archos 50e is a really good entry-level smartphone. The company has done a great job of cramming it full of worthy features while still keeping the price lower than the competition.

For around £95, the Archos 50e Helium would make for an ideal first phone or separate dual-SIM work device.

**mm David Hayward**

**A good entry-level phone that's ideally priced**





# Urbanista Melbourne Portable Bluetooth Speakers

Urbanista delivers a small speaker with big sound ambitions

## DETAILS

- Price: £59
- Manufacturer: Urbanista
- Website: [uk.urbanista.com/](http://uk.urbanista.com/)
- Requirements: Bluetooth audio device

There was a time when anything Bluetooth was inherently special, but these days this low-power wireless technology is practically omnipresent.

One trick it can do that's helped it succeed is the ability to stream stereo audio while not exhausting the battery of the source phone or tablet.

The Urbanista Melbourne was designed to exploit the wonders of Bluetooth 4.0 and provide output better than a phone speaker for those on the move.

Portability is excellent, as it's almost exactly the same size as the old iPhone 4 (or new 6SE), but a good bit thicker at 22mm.

Being relatively small, you might think it wouldn't generate much noise, but it's surprisingly loud. According to Urbanista, inside are three +3W

40mm drivers, plus a 50mm passive radiator.

The 'passive' radiator isn't as static as that description might suggest, because when audio is being pumped through the Melbourne, it oscillates in and out of the back – something that can feel momentarily odd when you pick it up.

Another curiosity is the rubberised coating that encases the whole device. This empowers the unit with IPX4-certified

splash resistance, but it doesn't actually enable it to survive complete immersion.

As good as this covering is, there are a couple of drawbacks to it. The first was that it took me an age to initially locate the small panel that peels back to reveal the USB charging port and the direct 3.5mm audio socket. And it also makes reading the symbols on the control buttons almost impossible. These either need more relief or to be highlighted in a different colour, because otherwise they're almost invisible on the black review model.

Maybe on the white, 'blue petroleum' or 'rose gold' alternative colour schemes they're easier to see, I hope.

Urbanista also provides a very short charging cable and what looks like a short shoelace, which is used as a carry strap.

A full recharge takes about two hours, and after that you'll get about six hours of playback – less if you like thrash metal,

I'd suggest. That's not exceptional, but ones I've seen that lasted longer were substantially larger than the Melbourne and could therefore include more battery capacity.

The true strength of this design is that the sound quality is half decent, and it's such a small and insignificant weight that it won't overload a beach bag.

It's not the cheapest Bluetooth travel speaker I've seen, but it does generate a decent volume of undistorted sound from a remarkably compact and generally well-conceived design.

**mm Mark Pickavance**

**A small speaker with impressively high volume**

## Urbanista Melbourne Features

- Bluetooth 4.0.
- Speaker size: 3 +3W 40mm full range plus 50mm passive radiator.
- Sensitivity: 80dB ±2dB SPL @1KHz.
- Impedance: 4ohms ±15% @1KHz.
- Frequency: 100-20000Hz.
- Microphone for answering calls.
- Playing time: about 6h/li>.
- Charging: Micro-USB, about two hours charging time.
- OS Support: Android, iOS and Windows.
- Weight: 180g (without box).
- Size: 130x65x22mm.





# GROUP TEST

## Colour Lasers

At one time, colour laser printers frequently cost more than the companies using them, and each page printed was valued at tens of pence.

Not any more, though. A decent colour laser printer doesn't cost a king's ransom any more – and here are six of them to prove it

### Colour Lasers

## Brother HL-3170CDW

#### DETAILS

- Price: £199
- Manufacturer: Brother
- Website: [goo.gl/t3B5MW](http://goo.gl/t3B5MW)
- Requirements: Windows, OS X, Linux, networking, USB cable for local connection

The Brother HL-3170CDW is a reasonably compact printer that's aimed at the small, busy office or home, where users need lots of connectivity and reliability. It would just be another bland-looking box if it wasn't for the added benefit of it being one of the first LED technology printers, which makes it more reliable than the average laser printer and a little cheaper to produce too.

However, the technology doesn't just stop with the LED feature. The 333MHz processor and 128MB of memory help drive a printer that has ample connectivity in the form of USB, Ethernet and 802.11n wi-fi. Mobile connectivity is supported well, with AirPrint, Cortado Cloud Print, Google Cloud Print, iPrint&Scan, and WiFi Direct. And you can administer the

printer functions over the network just as well as if you were standing in front of the tiny LCD control screen.

Furthermore you get an automatic double-sided print to help save paper, and a 'Deep Sleep Mode', which can be configured to send the printer into hibernation for a custom amount of time after the last print. When in this mode, the printer drops to a very economical 1.5W power consumption. When a print does come through, it takes about 12 seconds for the printer to wake up and start printing.

There's a 250-page input tray as standard, which fed our text test document through at a rate of around 16 pages per minute, with the first page appearing within 18 seconds of the request being sent through. The colour PPM was good too, coming to around 12 pages per minute.

The page quality was good, and the printer accepted everything we threw at it without any misprints, queue errors or anything else like that.

The text page quality was sharp and readable, and the colour print test was remarkably good and of a much higher quality than we initially thought it would be.



In fact, the HL-3170CDW has one of the better colour laser print-outs we've seen in a long time.

The replacement cartridges are reasonably priced as well. The genuine Brother multi-pack for this model costs in the region of £165 and offers a yield of 2,500 for the black and 1,400 for the three colours. This comes to around 2.5p per page for consumer costs, but we also found a third-party brand that offers a 2,500-page yield for the black cartridge and a better 2,200 pages in the colour cartridges – all for just £84.86, making the consumer running costs 0.9p per page.

Although the initial cost of the printer is around £200, depending on where you shop, the lower running costs and higher than normal yield of the average toner replacements make for a far more efficient printer. And considering the quality of the print you get, the ample connectivity and the power saving feature, the Brother HL-3170CDW certainly has a lot going for it.



▲ The Brother HL-3170CDW is a good compact LED laser



▲ The toners too are reasonably priced



# HP Colour LaserJet Pro M252dw

## DETAILS

- Price: £150
- Manufacturer: HP
- Website: [goo.gl/Oz3Tge](http://goo.gl/Oz3Tge)
- Requirements: Windows, OS X, Linux, networking

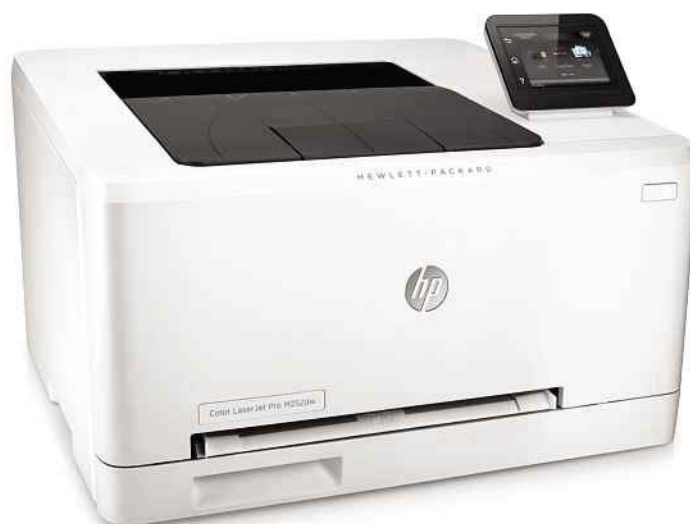
**A**t times, it feels like HP releases a new printer every other day. As soon as one is delivered, another takes its place in the list of available products. That's not a bad thing, though, because it means the company is always pushing the envelope.

The Colour LaserJet Pro M252dw is one of the newer entries to the HP fold. It has an 800MHz processor and 256MB of memory as standard, with a single USB port, Ethernet, 802.11n wi-fi and a USB host port for you to stick a USB pen filled with photos into.

There's a 150-sheet paper tray at the bottom front of the printer and a 73mm flip-up colour touchscreen where you can get to the basic settings as well as view any thumbnail images from the USB stick you've inserted. You also get access to a small collection of HP online apps.

Print speeds are generally good. The text document we fed through took around ten pages per minute, with the first page being printed within 15 seconds. The colour test managed a respectable nine pages per minute, with the first page being printed within 18 seconds.

The mono print quality was excellent. The characters were crisp, easy to read and showed no sign of misprints or banding. The colour



▲ The HP Colour LaserJet M252dw is a great colour laser printer



▲ It's easy to use and has more than enough features for most users

“ What made this printer stand out from the others was just how quiet it was ”

photos we tested were good too, although they weren't quite as bright as the Lexmark model.

What made this printer stand out from the others, however, was just how quiet it was. Although the noise

factor wasn't something we were paying too much attention to, the HP M252dw was virtually silent in comparison to the other printers we tested.

Pricing for the multi-pack of toners is quite expensive,

though. The genuine high-yield multi-pack, consisting of 2,800-page black and 2,300-page colour, costs £234, which offers a cost per page of 2.4p. The standard multi-pack of 1,500-page black and 1,400-page colour costs a cheaper £185, at 3.2p per page.

If you shop around, you could probably find a third-party set for less. Obviously you're better off buying the higher-yield cartridges, as the standard multi-pack will make this the most expensive printer in the group in terms of running costs.

Saying that, the print quality is good, and you can easily pick the HP Colour LaserJet M252dw up for around £150, which isn't too bad. You also get a 1,500-page and 700-page yield black and colour cartridge in the box, which again is quite good.

The HP Colour LaserJet Pro M252dw has a lot going for it. It's a good colour laser with great quality and connectivity, and we like the top-mounted USB port too. If we could find somewhere with much cheaper cartridges for it, we'd be even more impressed.





## Colour Lasers

# Lexmark CS310n

### DETAILS

- Price: £170
- Manufacturer: Lexmark
- Website: [goo.gl/WMBh3s](http://goo.gl/WMBh3s)
- Requirements: Windows, OS X, Linux, Unix, USB cable needed for local connection

**T**he Lexmark CS310 range was launched a few years ago and has proved to be quite popular for home and businesses users alike. Surprisingly, it's still at the top of the Lexmark product list, which goes to show just how sturdy and versatile the range is.

The Lexmark CS310n is a four-colour cartridge printer that can take 250 pages on a standard input capacity tray (with the option to purchase an additional sheet feeder), and it comes with a decent-sized 750-page colour and black toner cartridge.

Connectivity is a reasonable mix of USB and Ethernet, with an optional wi-fi adapter available through various Lexmark retailers. It's powered by a remarkably powerful dual-core 800MHz processor with 256MB memory installed as standard, but again this can be upgraded to a far more impressive 2GB should you ever deal with ultra-large documents from many users.

The business elements of the printer are some of its main features, as it's compatible with Windows, Mac, various Linux distros, Citrix MetaFrame, Unix and Novell systems. That same support also extends to the many network printing protocols and methods, as well as network management



▲ Although it doesn't look to thrilling, the Lexmark C310n is a good printer



▲ There's a lot of business speak within the specification, but it's all good

protocols. There are far too many to list, but simply put, there's not much this printer can't be connected to and work with.

For the home, this is quite an impressive workhorse. The OS and networking support may seem a little extreme for printing out the odd receipt or full-colour holiday snap, but at least you're guaranteed

a higher than average level of technology.

In terms of quality and speed, the Lexmark does well. The text test document printed within 12 seconds for the first page, then around 25 pages per minute thereafter. The text was clear and readable, and although we've seen sharper prints before on other models, the output

from the CS310n was more than adequate for most users.

The same can be said for the colour output, which completed the first page in 14 seconds and after that settled down to about 27 pages per minute. Colours were good, reasonably bright and well balanced. Provided you're not considering printing out a full-colour magazine, you'll be satisfied with the output.

The best price we found for a multi-pack (black, blue, yellow and magenta) was £330. This is for a 3,000 page yield on the colours and 4,000 pages with the black, which roughly equates to 2.5p per page, and that's with a genuine Lexmark set of cartridges. The alternative third-party brand offering comes to a reasonable £166, with the same page yield as the genuine Lexmark cartridges, which translates to around 1.3p per page.

The printer itself costs in the region of £170, although you could probably shave off £10 or so if you shop around. This is undoubtedly a good printer, but it's probably overkill for home users.





# Xerox Phaser 6600

## DETAILS

- Price: £260
- Manufacturer: Xerox
- Website: [goo.gl/QhwX3R](http://goo.gl/QhwX3R)
- Requirements: Windows, OS X, Linux, USB cable needed for local connection

We imagine somewhere out there, someone has a room full of Xerox Phaser 6600s and says on a daily basis, "Fire all Phasers!" – or something to that effect. In reality, of course, we're quite jealous, because we only have one available, and it doesn't make a cool *Star Trek* sound effect when powering up.

The Xerox Phaser 6600 comes in two different versions: the V/N, which doesn't have a duplexing feature, and the V/DN model that does. Beyond that, both models are similar and feature a 533MHz processor with 256MB of memory as standard with the option to increase that to 768MB.

There's a 250-sheet output tray located at the bottom of the printer, and it comes with a USB port and Ethernet connections – sadly the wi-fi isn't standard, but comes as an optional extra.

The printer itself looks okay. It has a large plastic, sloping top that's coloured blue, which meets the familiar off-beige of the main body in a wave pattern. There's a simple digital readout LCD on one side of the top of the printer, with a circular button arrangement clustered underneath. It's pretty basic, but it works, and you can get to all the necessary functions easily enough.

The print speeds were quite good here, with the text tests fed through at 18 pages per minute and the first page printed



▲ The Xerox Phaser 6600 sounds pretty cool, but it's not the best laser we've tried

“ The quality of the colour prints makes us wonder if it's actually worth it ”



▲ The design is a bit more colourful though than some of the competition

in around ten seconds. The colour print even managed a decent ten pages per minute, but the first page took over 40 seconds to start once the job had been sent to the printer over the network.

The quality of the basic text print was decent – at least as good as the HP model. The characters were sharp, well defined and easy to read. The colours, however, seemed a little too dull for our liking and not as vibrant as some of the other printers in the group.

Despite that, the cost of toner cartridge replacement isn't too bad. The genuine four-colour multi-pack of 8,000-page black and 6,000-page colour costs £440, offering 1.7p per page. The third-party set of cartridges were far better, offering the same yield as the genuine cartridges but at a more agreeable £132, which comes to an impressive 0.5p per page.

The Xerox Phaser 6600 can be bought for around £260, which makes it one of the most expensive printers on test. While the toner is reasonably cheap and the print speeds are fast, the overall quality of the colour prints does make us wonder if it's actually worth the initial expense.

Having said that, it's a sturdy printer and will no doubt suffice for home users or small offices. For better quality prints, though, look elsewhere.





## Colour Lasers

# Epson AcuLaser C2900N

### DETAILS

- Price: £250
- Manufacturer: Epson
- Website: [goo.gl/CDv9qm](http://goo.gl/CDv9qm)
- Requirements: Windows, OS X, USB cable for local connection

**E**pson's range of home, SOHO and business class laser printers are pretty impressive. There are lots to choose from, with their own unique feature sets, printing speeds, toner usage and so on.

The AcuLaser C2900N is one of the base models available in the range, but that's not to say it's lacking in any way. It uses the AcuBrite toner system, which uses smaller, chemically grown toner particles along with special pigments, delivering higher print quality than normal. Epson also claims the AcuBrite system has less of an environmental impact through its manufacture and use.

It has reasonable connectivity, with USB, gigabit Ethernet and a handful of network management protocols in the form of SNMP, HTTP, DHCP, BootP, DDNS, mDNS, SNTTP and Ping. Internally the printer has a 400MHz processor with 256MB of memory as default, with the option to further increase the amount to a maximum of 768MB.

As for design, the C2900N reminds us of an older Apple printer. Other than the slightly nostalgic appearance, though, it's a fairly nondescript printer. That's not a bad thing, however, since Epson clearly decided to focus on the operation rather than splashes of colour or wavy lines.



▲ The Epson AcuLaser C2900N's design reminds us of an old Apple printer



▲ It's a good enough printer, and it's cheap to run

The C2900N comes with a 251-page standard input tray, which fed our text print tests through at a reasonable 20 pages per minute, with the first page being printed at around 16 seconds. The colour pages came through at a more sedate 12 pages

per minute, with the first colour page printed within 20 seconds of the data being sent.

The print quality was good throughout. The text was clear, sharp and very readable. The colour pages too were good, although the

reds did seem a little darker than what we're used to. However, the other colours used were quite bright and vibrant – enough for a good print-out of a photo.

The genuine Epson toner multi-pack we found cost £268 and offered a 2,500-page yield for the three colours and 3,000 pages for the black. This comes to around 2.6p per page, but we also found a third-party multi-pack of cartridges for just £80, with the same colour yield of 2,500 and 3,000 pages for the black. This dropped the overall cost to an impressive 0.8p per page, making this quite a cost-effective printerr.

We found the Epson AcuLaser C2900N for around £250, putting it just behind the Xerox in terms of cost. It's not a bad printer, but we have seen better examples from the likes of HP, which are somewhat cheaper too.

On the whole, though, it's okay and fairly cheap to run and maintain.





## Dell C1765nfw

### DETAILS

- Price: £350
- Manufacturer: Dell
- Website: [goo.gl/Jv8UHR](http://goo.gl/Jv8UHR)
- Requirements: Windows, OS X, Linux

This is the second LED printer in the group, and it's from Dell as opposed to one of the bigger printer manufacturers.

In case you're not aware, an LED printer differs slightly from a more traditional laser printer. In layman's terms, instead of using a laser to target a spot of toner, the LED uses an array of LEDs across the entire print area of the page. The process doesn't make an LED printer faster or have a better quality output, but it makes them cheaper to manufacture and in some respects a little more reliable, since there are fewer moving parts.

Moving back to the Dell, this is an all-in-one office printer that scans, copies, faxes, prints, has support for USB, Ethernet, wi-fi, mobile printing, cloud printing and goodness knows what else. The only thing it apparently doesn't do is make the tea.

As standard, it has a 150-page tray, a 295MHz processor, 128MB of memory and support for a number of operating systems. Controlling and administering the printer is easy enough via the LCD panel and numerous buttons; the same goes for setting it up on the network as well.

Print speeds were okay, with the text document coming through at a rate of about 12 pages per minute and the colour one taking a little longer at ten pages per minute. However, we did find that the printer took nearly four minutes to start

printing, during which time there were some horrible grinding noises coming from somewhere within the bowels of the chassis.

The print quality wasn't brilliant, unfortunately. The text that was produced, while okay, wasn't as sharp as we would have liked. The colour, too,

was muted and quite dark. Whether this is something inherent with older LED printers, we're not sure.

The genuine Dell toner multi-pack costs around £198, with a yield of 2,000 pages for the black and 1,400 for the three colours. This works out at about



▲ The Dell C1765nf is pretty much at the end of its life

◀ Although cheap to run, it's not a great printer

3.2p per page, but if you shop around for the premium third-party cartridge, you can pick up a multipack for around £59 for the same page yield. This means that with the third-party cartridge, you'll be getting something like 1p per page, which isn't too bad at all.

The main problem we have with the Dell C1765nf is that it's at the end of its shelf life. Dell seems to be in the process of removing all trace of it, but the likes of Amazon are picking up the slack, as are a number of other sellers. It's not the best laser printer on test, and with it costing £350, it's also the most expensive. One to avoid.





### Brother HL-3170CDW

We really liked the Brother HL-3170CDW. It has pretty much everything you need from a workgroup laser.

The prints are good too, and if you stick with the third-party multi-pack, the cost per page is less than one pence per page.



### HP Colour LaserJet Pro M252dw

Even though we couldn't find any good third-party toners to use, the cost per page of the HP Colour LaserJet Pro M252dw isn't too bad.

What's more, it's the cheapest printer to buy in the group and the quality is good.

## How We Tested

Each printer was tested with a selection of 20 full pages of text, and 20 full-colour photos and blocks of colours. We used all connections where possible, as well as printing from the cloud and apps via phones, tablets and PCs. All toner costs were calculated through [CartridgeSave.co.uk](http://CartridgeSave.co.uk).

	Brother HL-3170CDW	HP Colour LaserJet Pro M252dw	Lexmark CS310n	Xerox Phaser 6600	Epson AcuLaser C2900N	Dell C1765nf
Price	£199.98	£150	£170	£260	£250	£350
Technology	LED	Laser	Laser	Laser	Laser	LED
Dimensions	410 x 465 x 240mm	392 x 412 x 236.2mm	291 x 442 x 407mm	430 x 488 x 384mm	404 x 469 x 413mm	410 x 379 x 338
Weight	18.1kg	12.2kg	20.1kg	25.5kg	18.4kg	15kg
Connectivity	USB, Ethernet, wi-fi	USB, Ethernet, wi-fi	USB, Ethernet	USB, Ethernet, wi-fi optional	USB, Ethernet	USB, Ethernet, wi-fi
Genuine Toner Cost (Multipack)	£165	£234	£330	£440	£268	£198
Premium Toner Cost (Multipack)	£84.86	Not found	£166	£132	£80	£59
PPP Costs Genuine	2.5p	2.4p	2.5p	1.7p	2.6p	3.2p
PPP Costs Premium	0.9p	N/A	1.3p	0.5p	0.8p	1p



# Top 5

## Disappointing PC Games

We waited, we waited some more, and then... meh

### 1 Alien: Colonial Marines

When your game is so disappointingly terrible that it results in a class action lawsuit being brought against you, you know you've failed in a really special kind of way. Yes, that's exactly what happened to this game's developer, Gearbox Software, and its publisher Sega. According to the people who initiated the lawsuit, footage of the game shown at press and public events before its release weren't representative of the final product, in spite of being presented as actual gameplay. If you haven't seen the preview footage or the actual game, this video is worth a look: [youtu.be/g1orK2qj\\_9k](https://youtu.be/g1orK2qj_9k).

In short, they promised sophisticated AI, gorgeous graphics and an immersive story. What player actually got was something that looked like it was made to run on a PlayStation One, with the stupidest aliens in the universe to fight against.

### 2 Duke Nukem Forever

When *Duke Nukem Forever* was first announced, R Kelly's 'I Believe I Can Fly' was flying high in the charts, Channel 5 had just been launched, and the world had just got its first taste of the Teletubbies. By the time it was released, someone called Pitbull was asking you to 'Give Me Everything', Freeview had massively swelled the number of TV channels, and the Teletubbies had disappeared (and were no doubt planning their 2015 comeback).

Yes, this game took so long to be developed and released, many people considered it to be vapourware. Eventually, though, in 2011, it was released, but by this time it had changed developer and was created by... ahem... Gearbox. As we all now know, the 15-year wait was most definitely not worth it. The game turned out to be a complete dud.

### 3 Watch Dogs

By no means a bad game, *Watch Dogs* suffered from being hyped far too much before release. The promise of being able to hack anything in a huge virtual city was an intriguing prospect, but the reality was nowhere near as revolutionary as players were expecting.

In the end, with all the driving elements and open-world play, *Watch Dogs* felt more than a little like a *Grand Theft Auto* clone, with just a few novel differences to make it stand out.

Ultimately, it was a decent game, and the healthy sales reflected that, but if you were basing your anticipation on the publicity that surrounded it prior to release, it was hard not to feel let down.

### 4 Bionic Commando

The original *Bionic Commando* came out in 1987 and was a simple 2D platformer. By the time this remake was released, it was 2009, so Capcom's relaunch of this franchise was always going to be a departure from its origins. Nevertheless, fans of the original were excited by the prospect of once again donning the hero's bionic arm and grappling gun.

But like many hugely hyped games, it couldn't live up to expectations. And what made things worse is that the game, like other Capcom titles such as *Resident Evil 4*, was a lacklustre console port. It did still garner some positive reviews, but it's safe to say many people, particularly PC players, didn't get the experience they were expecting.

### 5 Spore

Ah, promises, promises. Way before its release, we were told how we'd be able to take a simple one-cell organism through every stage of evolution, right up to the point they develop space travel. And yes, *Spore* did give us that, but it was also surprisingly lacking in depth.

In spite of this, critics lavished the game with praise, and it looked like it might actually live up to its hype. Players, however, did not form the same general opinion as the critics. For a start, they had to deal with the hell that was SecuROM, a DRM system that limited the number of installations and required always-on internet access.

Once they'd got past that, what they found was a game that was oddly limited, extremely linear and generally quite repetitive. As the current Metacritic scores suggest (84% from critics and 5.2 out of ten from users), the positive scores seem to have been little more than a case of the emperor's new clothes.



▲ This image is approximately 293% more exciting than the game itself



# Guide to GitHub

**David Briddock explains how to take advantage of this cloud-based development repository**



**G**itHub was created to act as a cloud-based development source code repository for individuals, established companies and startups. Despite appearing only six years ago, today GitHub ([github.com](https://github.com)) is an essential resource for the open source community.

Did you know its appeal extends far beyond software development, though? In fact you can store any kind of textual document, spreadsheets, presentations, images and other media files using its resources. For example, visit the Raspberry Pi Foundation's GitHub repository ([github.com/raspberrypi](https://github.com/raspberrypi)) and you'll find a wide assortment of files including firmware, Linux and NOOBS software, the complete HAT specification and a full set of official documentation.

In this guide we'll explain why GitHub is so popular, highlight some of its key features, then show how to get involved by creating your own GitHub repository.

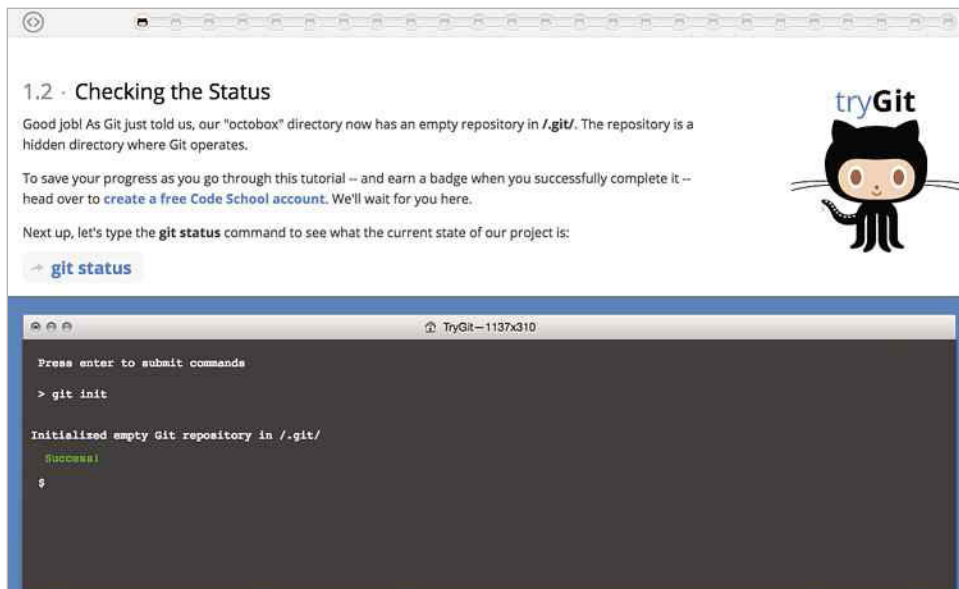
## History

Git was created by Linux kernel developers to manage their own source code files (see boxout). However, while Git is still a very popular tool in the Linux community, the command-line interface tends to restrict its widespread adoption. It's this deficiency that led to the creation of the GitHub project.

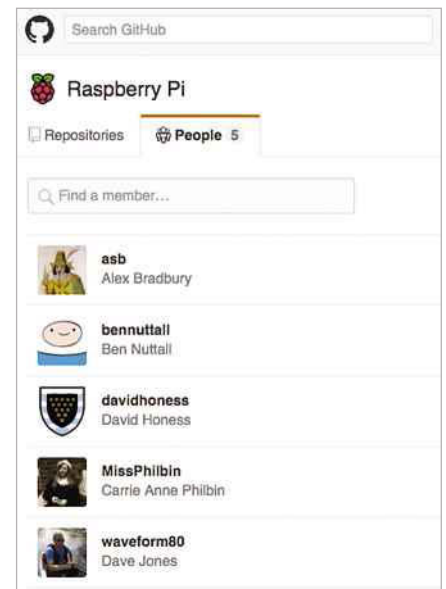
The GitHub website is essentially an easy-to-use front-end to Git. Conceived by Tom Preston-Werner, Chris Wanstrath and PJ Hyett in late 2007, after a short beta-testing period, this team launched the website in April 2008. GitHub delivers core Git functionality through a simplified graphical user interface, or GUI, and being browser-based means it supports any desktop or laptop PC, plus many tablets and smartphones. So every project, large or small, can use the same set of powerful tools to help push it towards completion.

Today GitHub is the largest code hosting environment on the planet, with over 31 million repositories, which are accessed by around 12 million users. It offers both free public-access accounts and paid-for private-access repositories.





▲ The [try.github.io](https://try.github.io) website



▲ GitHub Raspberry Pi people

## Key Features

GitHub delivers two key pieces of Git functionality that aid collaboration between teams of coders, they are known as source code management and distributed revision control.

The former is sometimes referred to as 'version control' or 'revision control', and works to track each and every change that's made to source code, configuration files, documentation and other similar textual documents. These changes could be as small as a single character or extend to the complete replacement of the text. Each block of changes corresponds to a specific version of the code or document file. And this means it's possible to travel back in time and retrieve a specific version, something that's immensely useful when trying to track down software bugs.

Source management is of critical importance when files are authored and edited by a team of people. This type of interaction is generally called 'distributed revision control' or 'decentralised version control'. In practice it means the various files have a distributed collection of working copies that are shared between a group.

Additional collaborative GitHub features include granting read/write/admin-level file access, bug tracking utilities, task management tools and project-specific wikis. Also, its social networking integration helps team members keep tabs on project status and easily follow activity feeds.

## Browse And Download

Anyone can browse a public GitHub repository, all you need is a browser. Most have a sizeable collection of files. In fact, the majority of repositories have numerous named folders, each of which can contain more files and sometimes a number of subfolders.

Exploring a repository is a great way to discover what it takes to create an app, plugin, utility or game. You'll probably be surprised at how many files are involved. Along the way you'll learn quite a bit about software development and pick up some coding tips and tricks.

A typical software project has code files written in more than one programming language. For example, a web browser plugin invariably has numerous HTML, CSS and JavaScript files, which are often supplemented by plain text, XML configuration and image files.

If you find something of interest, say a cool piece of code or a handy app, there's a couple of things you can do. If it is a text file you can simply copy the content, either everything or just specific sections, and paste it into your own file.

This copy and paste approach is fine if you're cherry-picking bits and pieces. However, if there are a few things that spark your interest it's better to download the complete repository using the button on it's home page. This will download a zip file to your PC containing all the repository's files, folders and sub-folders.

## Git History

Up until 2005 the Linux community relied on the BitKeeper source control management (SCM) tool to handle collaborative projects. BitKeeper wasn't open source, however, and the copyright holder Larry McVoy withdrew free usage after falling out with another developer, who he accused of reverse-engineering the BitKeeper protocols.

Linus Torvalds, the father of Linux, wanted a replacement. Yet he couldn't find a freely available solution that met his needs. Performance was a particular problem with one SCM tool needing 30 seconds to apply a single patch and update all associated metadata. This wasn't acceptable when Linux kernel maintenance operations often require 250 such actions at a time.

So in 2005 a team of Linux developers, headed by Torvalds, started the Git project. The primary focus was on building a fast and fully-featured SCM tool for the Linux kernel community.

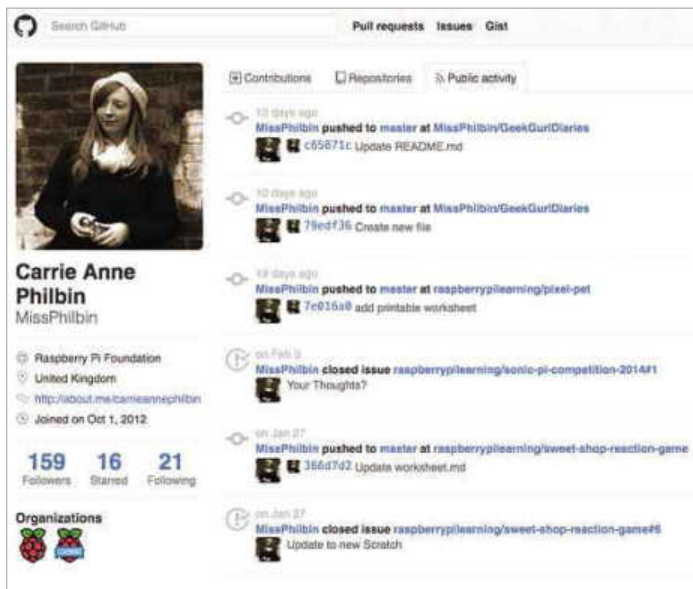
Git is designed around a distributed version control architecture. So every Git working directory is a fully-fledged repository with detailed change history and full version-tracking capabilities. Each one is completely independent of network or server.

It's no surprise to find that Git, just like the Linux kernel, is free software distributed under the terms of the GNU General Public License (version 2). As for the rather unusual name it was chosen by Torvalds because he'd always considered himself to be an unpleasant, strong-minded, confrontational individual.

➤ [Linus Torvalds](#)







▲ GitHub Activity example

## Sign Up

Free and open access to all these GitHub goodies might be all you're after. However, if you'd like to create a repository and upload your own content you'll need to go online and sign up for a GitHub account. It's a pretty simple and quick process: provide a username, email address and password and you're free to create and manage your repositories. Though remember, by default anything you store in your repositories is publicly available.

You can create as many repositories as you like. However, as your repository collection grows, it's important to give each one a meaningful name. These names also help others when searching for specific GitHub content.

As a signed up user you're also able to contribute to repositories set up by other people or organisations, by submitting new content or modifications (more on this later).

## Apps And Plugins

Once you've created a repository or two on the GitHub website you're free to add, update and remove files. However, this is invariably a rather tedious process using only the browser. So the best plan is to do all the editing on your PC.

The simplest way to manage your repository files on a PC is to download a Git app or plugin. They make it much easier to synchronise your additions and changes with the online GitHub repository. Apps are available for all the popular platforms including Windows, Mac OS X and all flavours of Linux. These apps offer an easy-to-use Graphical User Interface (GUI), so you don't have to learn a collection of Git commands to create repositories, upload new files and update existing files.

GitHub plugins are all about integrating Git functionality into an existing development workflow. This means you'll likely download and apply a plugin for your favourite editor or Integrated Development Environment (IDE). Popular examples include the Eclipse IDE ([eclipse.org/egit](http://eclipse.org/egit)) and editors like Sublime ([sublimegit.net](http://sublimegit.net)).

For fans of the good-looking Atom editor (which incidentally includes myself) it's even easier as this editor has built-in Git support, including colour-coded flags in the file tree, code gutter and status bar ([atom.io](http://atom.io)).

Simply download and install your chosen app or plugin, fire it up, sign in to GitHub and you are good to go.

## Clone To PC

Once you have an app or plugin your next step is to get the repository files. There's a dedicated 'Clone' button on the repository home page. It's located next to the 'Download Zip' button and has an icon that looks like a desktop with a downward facing arrow.

Simply click this button to initiate a digital transfer between the GitHub website and your PC. It won't be too long before you'll see the chosen repository appear in your GitHub app's window or development tool. Now you can simply edit the files with your favourite tools, before synchronising any changes.

Here's a useful tip. When committing your changes make sure you provide meaningful comments. Informative comments ensure the change history log is an accurate record of what actually happened. It's especially important when working in a team environment.

## Collaborative Coding

At some point you might decide to contribute to a GitHub project owned by someone else. For instance to perform a documentation update or add some new functionality to a web browser plugin or enhance a *Minecraft* mod. The starting point is to create a new branch.

A branch is essentially a duplication snapshot of the current repository. With this branch you can experiment all you like, adding new code and even breaking things, without impacting anyone else. All branches have names. In fact when you create a repository something called the 'master' branch is automatically created for you.

To create a new branch in GitHub you'll need to perform a fork operation. There's a dedicated 'fork' button on each repository home page. Once clicked you'll need to select a destination repository to complete the operation. This may be a repository you already own or one where you've been assigned write access.

GitHub also has a social network graph capability that helps to visualise a repository's fork and branch activity over time. So you can also see what other people are working on.

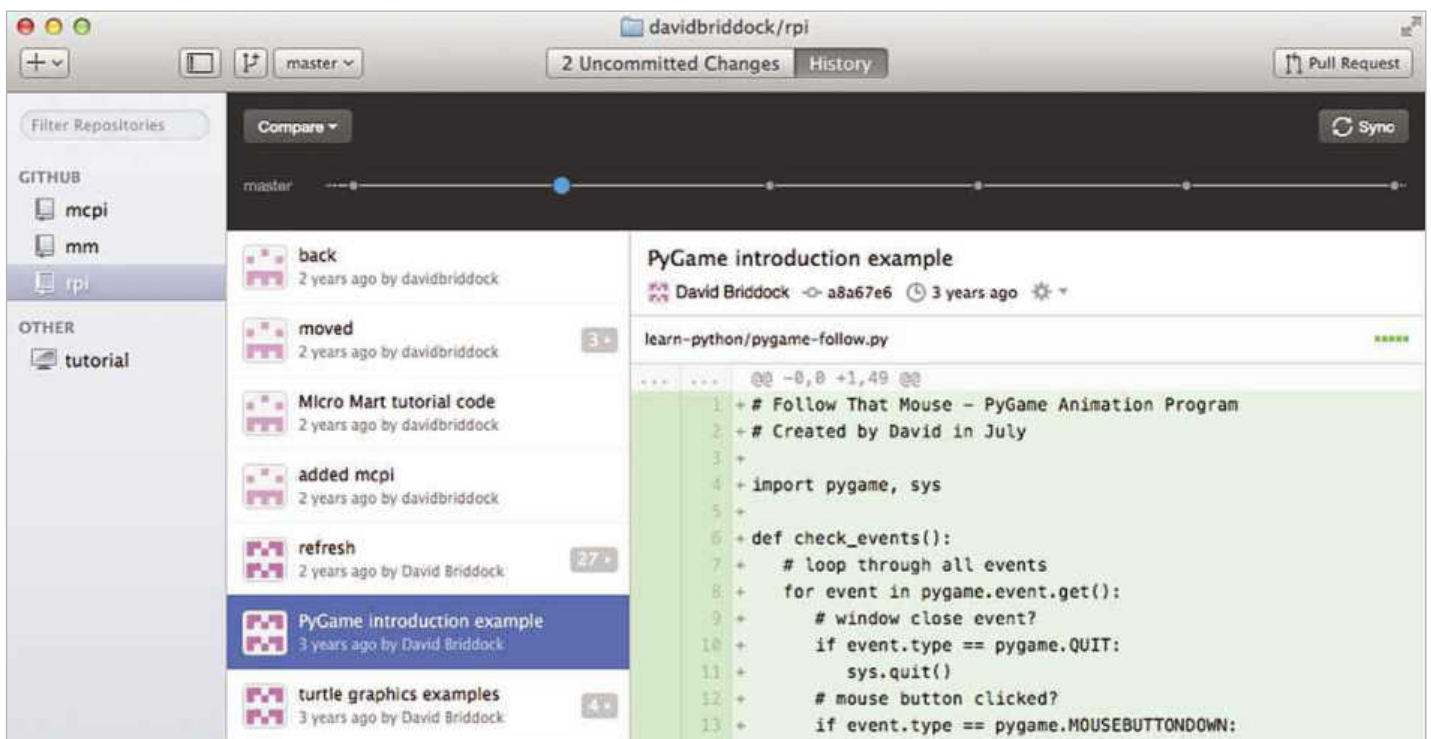
Once you've finished making your changes and completed any relevant testing it's time to submit them back to the original repository. However, it's always up to the repository owner to decide whether any of these changes will be accepted. This collaborative change review process is an essential part of the GitHub workflow.

## GitHub Repositories

Here's just a few public repositories for you to check out while you get to finding your way around:

**Raspberry Pi:** [github.com/raspberrypi](https://github.com/raspberrypi)  
**Google:** [github.com/google](https://github.com/google)  
**Google Chrome:** [github.com/googlechrome](https://github.com/googlechrome)  
**Microsoft:** [github.com/microsoft](https://github.com/microsoft)  
**Twitter:** [github.com/twitter](https://github.com/twitter)  
**Facebook:** [github.com/facebook](https://github.com/facebook)  
**Apache:** [github.com/apache](https://github.com/apache)  
**YouTube:** [github.com/youtube](https://github.com/youtube)  
**W3C:** [github.com/w3c](https://github.com/w3c)  
**Oculus VR:** [github.com/OculusVR](https://github.com/OculusVR)  
**BBC News:** [github.com/BBC-News](https://github.com/BBC-News)  
**The Guardian:** [github.com/guardian](https://github.com/guardian)  
**GOV.UK:** [github.com/alphagov](https://github.com/alphagov)  
**NASA:** [github.com/nasa](https://github.com/nasa)  
**The White House:** [github.com/whitehouse](https://github.com/whitehouse)





▲ GitHub App

## Pull Requests

So how do you submit your changes? With GitHub, it starts with something called a Pull Request; once again there's a dedicated button on the repository home page, although this time it will be the repository hosting your forked branch. A key aspect of Pull Requests is that they contain information about the changes made and the reasons behind each change. If you click the change log link, it will display all the changes (additions, updates and deletions) made on a specific file. They are shown as coloured-coded highlight lines. Open the commit tab to enter your change comments.

A Pull Request instigates a 'live conversation' that streamlines the process of discussing, reviewing and managing repository changes. This conversation allows all interested parties to evaluate the proposed modifications. It's a key step as it allows everyone to have their say on the changes as a whole, certain sections or even one specific line.

Once accepted, a Pull Request can be 'merged' back into the original repository. This is typically done on the 'master' branch. However, in some circumstances it may be better to merge it into another branch first, say to allow further testing on a suite of proposed changes from multiple developers before final acceptance is given.

## Going Private

GitHub is completely free to use for public projects. So anyone can create a repository and its contents will be shared with the world.

However, in some cases organisations or individuals want to have the ability to restrict access. This is achieved with a paid-for private GitHub repository, which operates in a similar way to a public repository and uses the same tool set.

Costs vary depending on the number of private repositories required. For an individual who only needs five private repositories the cost is a reasonable \$7 a month, while those working on bigger projects who need 50 private repositories will have to shell out \$50 a month.

Organisational level plans are aimed at business teams and offer permission level configuration support. They start at the \$25 a month Bronze level with 10 private repositories, then go through Silver, Gold and Platinum up to the \$450 a month Diamond option with 300 private repositories.

There are also a number of Enterprise level licences to choose between, should they suit your needs. They start, however, at \$2,500 a year – but include maintenance, upgrades and support. [mm](#)

## Learning Git

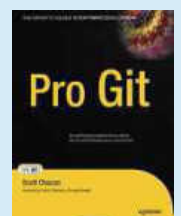
Exploring what's possible with Git can be a little daunting at first. Git has an extensive list of commands to learn and becoming proficient demands plenty of hands-on experimentation. Fortunately help is at hand. One of the most useful resources is GitHub's Git Cheat Sheet ([training.github.com/kit/downloads/github-git-cheat-sheet.pdf](https://training.github.com/kit/downloads/github-git-cheat-sheet.pdf)), which includes all the most commonly used commands.

Git newbies might like to try the online Try Git experience, which is designed to teach you the basics in just 15 minutes ([try.github.io](https://try.github.io)). This website presents an interactive set of Git command lessons based on an imaginary GitHub repository.

If you're after a comprehensive reference, one that covers every aspect of Git in detail, then download the open source ProGit book ([progit.org/book](https://progit.org/book)). Written by Scott Chacon it's available in PDF, EPUB, MOBI and HTML formats.

And finally GitHub has its own collection of help pages at [help.github.com](https://help.github.com) plus an official YouTube channel with stories and useful tips ([youtube.com/user/github](https://youtube.com/user/github)).

► Pro Git book







# Facebook In The Future

**Mark Zuckerberg has big plans for his company – and big predictions about the future. Sarah Dobbs checks out what's in store for Facebook (and us)**

**W**hen you're running a company as enormous as Facebook, it might be easy to rest on your laurels. Facebook is so ubiquitous that it's become easier to use it than not to use it, whether you're a grandparent wanting to see what your grandkids are up to, an up-and-coming musician wanting to promote your work, or, you know, just a person who likes to keep in touch with their friends. So it'd be hard to blame Mark Zuckerberg and co if they just sat back and let things carry on as they are. However, as Zuck's presentation at the F8 Facebook Developer Conference proved, that's not the plan.

Actually, Facebook has got a pretty detailed and ambitious ten-year vision for what comes next. 2026 might sound like a



date from a science fiction movie, but Facebook's head honcho has grand plans for what he'll be doing by then, and it includes all kinds of equally sci-fi sounding technologies, which Facebook will adapt to, profit from – or maybe even develop. Ready to peer into Zuckerberg's crystal ball and see what the future has in store? Yes? Let's go...

## Virtual Reality

Virtual reality, as an idea, is hardly new, but when Zuckerberg talks about the potential for using virtual reality in the future, he's not thinking about the clunky headsets of the 90s, or even nowadays... Facebook acquired Oculus Rift in early 2014 – at the not inconsiderable cost of \$2bn – and Zuckerberg has also appeared at events to talk up Samsung's Gear headset, so it's pretty clear that Facebook reckons there's a much sleeker, powerful and desirable version of virtual reality tech in our near future.

“ Make a 360° video and post it to your profile, ready for your friends to view with their VR goggles ”

The virtual reality Zuckerberg envisions is one that lets people share their experiences with one another in a totally immersive way. So instead of typing a Facebook update to tell your friends about your amazing holiday, or even posting a few pictures, you could make a 360° video and post it to your profile, ready for your friends to view with their VR goggles – which, according to Zuckerberg, will be soon as light and easy to wear as normal glasses. All sorts of milestones and experiences could be recorded and shared, both personal and, inevitably, corporate too. Imagine VR concerts, or sporting events, all available exclusively through Facebook.

That might well be the future we're heading towards. The slide Zuckerberg used to illustrate Facebook's 10 year plan at F8 also explained how he sees all these new and exciting technologies working with Facebook: essentially, Facebook will be the ecosystem in which these various technologies exist, the platform on which developers create and display their products.

It makes sense, as Facebook already has the user numbers to support all kinds of new things. There is a hint of dystopia about it too, however, especially when you think about the various products and services Facebook has already snapped up: WhatsApp, Instagram and Oculus Rift central among them. Will the future see other innovative and popular properties similarly snapped up? Well, this is the Facebook version of the future, so for now, let's assume the answer is 'yes' and ignore any misgivings that might stir up.

## Artificial Intelligence

Artificial intelligence might seem like another hangover from the 90s, but Facebook is banking on it finally stepping out of its sci-fi shadow and becoming mainstream. One way we'll see artificial intelligence pop up on Facebook is in the form of chatbots, but the kind you may have tried to converse with back in the bad old days of AOL Instant Messenger. Nope, Facebook's plan for chatbots is for them to finally become useful enough that they can serve as a first point of contact between consumers and the brands that will drive it's profits.

To that end, the firm is building a chatbot platform for its Messenger client. The plan is that, rather than companies having to employ social media managers to sit and chat to consumers with questions or complaints all day, they'll build bots that can figure out a customer's issue and offer solutions – or even offer promotional discounts.

Though it sounds pretty straightforward, in reality there are likely to be plenty of bugs to work out. Just ask Microsoft, whose Tay.ai bot was rapidly hacked by Twitter trolls and taught to spew Nazi propaganda. Any algorithm for responses built into Facebook bots would need to be robust enough to withstand that kind of gaming of the system – or maybe just have such a limited repertoire and capacity for learning that it'd never pick up bad habits, even though that'd also limit its usefulness in dealing with genuine customer queries. Still, Facebook reckons the chatbot revolution is imminent, so keep an eye out for bots in your inbox in the near future.

Artificial intelligence will also help Facebook to maintain its platform and serve up relevant promotional content to users. Facebook already has AI in place for authenticating users and weeding out spammers, and its Top Stories algorithms are sorted by ever more sophisticated artificial intelligence that's trying to learn exactly what you want to see. That's not as simple as it sounds either, since so many posts on Facebook involve images or videos, so Facebook is working on teaching its AI to interpret this kind of content.

You might have already noticed that when you upload pictures, Facebook's software can pick out faces and suggest which of your friends you might have snapped photos of. That kind of thing is only going to get more prevalent as time goes on.

Again, there's something ever so slightly creepy about the idea of super intelligent computers programmed to recognise us and understand what we do and don't like. This is the world we've built for ourselves, though.

## Drones And Lasers

Okay, now it sounds like Zuckerberg has designs on becoming an actual Bond villain, but the reality of Facebook's vision for using these scary-sounding technologies couldn't be friendlier. In short, the plan is to provide internet connectivity to places that don't currently have the infrastructure in place to get online.

Facebook has been working towards a more connected world for years now; back in 2013, it launched Internet.org, a non-profit aimed at connecting up the estimated four billion people who don't currently have internet connections. The company's Connectivity Lab has come up with a few innovative ways of providing that connection, among them projects dubbed Aquila, Terragraph and ARIES.

Aquila is probably the most audacious of the lot. Facebook reckons it's figured out a way to deliver data via lasers beamed from solar-powered drones. It's even built and tested a prototype aircraft, which can deliver reliable internet connections. It's a pretty imaginative way of getting round the lack of cabling and infrastructure in some parts of the world, though it's got its own challenges as well – like keeping the drones flying out of the way of other aircraft, and keeping them powered and running in adverse weather conditions. If it works, though, it'd be far cheaper and quicker than setting up traditional connections in remote regions of the world.

Speaking of conventional infrastructure, the cabling that most of the world already uses is also struggling to keep up with ever increasing volumes of data transmission, but Facebook is also working on a solution for that, in the form of Terragraph. That's





▲ Facebook HQ looking futuristic

its name for its in-development wireless internet system that would see nodes installed throughout cities, delivering high-speed connections to urbanites.

Then there's ARIES (Antenna Radio Integration for Efficiency in Spectrum), which is Facebook's experimental method for improving radio towers, in order to increase the speed and capacity of mobile networks in remote areas.

Each of these projects is part of Facebook's grand vision for a faster, better and more widespread internet in the future. The company isn't quite ambitious enough to want to run the whole show, though. No, the plan is to invest in getting these technologies up and running, so that other operators can take over. Facebook would just benefit from introducing potentially billions more people to the internet and also helping to up connections for the people who are already connected. Altruistic, or a cunning plan to gain billions more eyeballs for its advertising? Depends how cynical you're feeling.

## Telepathy And Constant Communication

Everything covered so far sounds realistic, if ambitious. Chatbots are already a thing we mostly understand; virtual reality seems like it might finally take off; and drones, well, they're not quite as menacing or impractical as they might once have seemed. So to finish off, let's look at something Mark Zuckerberg has predicted for the future of communication that does seem rather unlikely.

Last year, in an online Q&A session, Zuckerberg mused that eventually people will be able to share their thoughts directly, without having to type them in or go through any interface. Nope, apparently you'll just be able to think something and all your friends will be able to pick up on it, or experience what you're experiencing.

He also reckons we'll all be communicating with one another even more regularly than we already are – constantly, in fact. Looking at the way communication has already evolved, especially over long distances, that might make a sort of sense. You used to have to write a letter, then you could make a phone call, or send

## In His Own Words

Zuckerberg's F8 presentation was far too long to print in full, but here are some choice quotes:

### On connectivity and the power of the internet:

"We stand for connecting every person — for a global community, for bringing people together, for giving all people a voice, for a free flow of ideas and culture across nations. And this idea of connecting the world has gotten stronger over the last century. You can now travel almost anywhere in the world in less than a day. Countries trade more openly and cooperate more easily than ever. And the Internet has enabled all of us to access and share more ideas and information than ever before. We've gone from a world of isolated communities to one global community, and we are all better off for it."

### On artificial intelligence and bots:

"I have never met anyone who likes calling a business. And no one wants to have to install a new app for every service or business that they want to interact with. We think that you should just be able to message a business in the same way you would message a friend. You should get a quick response and it shouldn't take your full attention like a phone call would and you shouldn't have to install a new app. So today we are launching Messenger Platform, so you can build Bots for Messenger. It's a simple platform that is powered by Artificial Intelligence, so you can build natural language services to communicate directly with people."

### On Aquila and drones:

"If you had told me 12 years ago that one day Facebook was going to build a plane, I would have told you that ➤





▲ And a data centre looking futuristic

an email, or post a Facebook update; each new development makes things faster, and the faster the communication method, the more frequently we tend to use it, sharing things we might never have bothered to communicate in the past.

Will we all want to share our every thought, all day every day, though? That sounds like it might maybe be a leap too far. After all, most of us already have some privacy-related concerns about the idea of sharing all our data with one or two big companies. Imagine letting a corporation in on your actual thoughts? That really is terrifyingly dystopian, with hardly any way to rationalise that paranoia away.

## Will We Still Like Facebook In The Future?

The big question mark that hangs over all of these amazing predictions of the future, of course, is – will Facebook still be around in ten years? After all, even the biggest brands can sometimes fail. Ten years is a long time, during which a lot of things can change.

The good news for Zuck and Co. is that all the signs look pretty good for Facebook's continued existence. Recent figures about social network usage show that Facebook is still top of the pile, with a massive 44% market share – Twitter, for the sake of comparison, was at just 5%. In terms of actual user numbers, Facebook has around 1.5 billion monthly users, which sounds pretty healthy.

Its bank manager is presumably pretty happy too, as Facebook's reported profits from the fourth quarter of 2015 stood at \$1.56bn. (that's £1.09bn) over just three months. No wonder the company feels it can afford to invest in developing new ideas.

If we could make one prediction to add to Zuckerberg's stock, though, it'd be this: something massively disruptive will happen between now and 2026. A decade in technology is a really, really long time, and no matter how well prepared anyone thinks they are, something always comes along to surprise them. Ten year plans are all well and good, but you've always got to leave space for the unexpected... [mm](#)

◀ you were crazy. But here we are. It has a wingspan wider than a 737, but it weighs less than a small car. It has solar panels on the whole width of the wings, so it can fly at about 60,000ft in the air, which is about twice as high up as normal commercial flight, and it can stay in the air beaming down internet for a few months at a time. In a few months, we're going to launch our first satellite into space to connect sub-Saharan Africa and people who don't have access the networks there.

### On Virtual Reality:

"We are building technology that's going to change the way that we all experience the world. ... Later this year, we're going to release these touch controllers that bring your hands into VR. So instead of looking around and feeling like you are immersed, you will now also be able to modify the world, where you will be able to pick things up and give them to other people and interact. It's going to add a whole new layer of immersion. And one reason why I think that this is also important is that – for our mission is that we're working on a whole new set of social experience as well across all these different VR platforms. Virtual reality has the potential to be the most social platform because you actually feel like you are right there with another person."

### On the next decade:

"That's the roadmap for the next 10 years. We are building the technology to give everyone the power to share anything they want with anyone else. And everything we are doing is about building technology that brings people together, because whether you just want to hang out with a few friends or start a business, or help solve the world's problems, the path forward is to connect people."



# Alphabet Pi: I

David Briddock meanders through Raspberry Pi technology from A to Z

## THIS WEEK: ISS, IoT and IP address

### ISS

With a Sense HAT, plus a few other inexpensive electronic components, you can transform the humble Raspberry Pi into a high-quality scientific instrument. An instrument worthy of being taken to space by British ESA astronaut Tim Peake, for his six-month stay aboard the International Space Station (ISS).

All this activity took place as part of the Astro Pi project ([astro-pi.org](http://astro-pi.org)). The Astro Pi device is built on a standard Raspberry Pi 2 board with attached Sense HAT, plus the official camera module and an infra-red camera module (the official camera module minus its infra-red filter). The whole thing is housed in a custom-designed flight case ([astro-pi.org/about/hardware](http://astro-pi.org/about/hardware)).

Tim Peake took two Astro Pi devices with him to the ISS. During his six-month mission they'll be used to measure the environment inside the station, reveal how it's moving through space and detect the Earth's magnetic field.

## “ Tim Peake took two Astro Pi devices with him to the ISS ”

The low-cost Astro Pi hardware offers a unique learning opportunity. Last year, students from schools across the UK took part in an Astro Pi competition ([astro-pi.org/competition](http://astro-pi.org/competition)). The challenge was to create the best scientific Python-coded programs for the Astro Pi. In the end, seven winners were chosen, spanning a number of different age groups.

Programs ranged from game-like reaction time tests to monitoring radiation levels inside the ISS ([astro-pi.org/competition/winners](http://astro-pi.org/competition/winners)). Tim Peake will run each winning program inside the ISS European Columbus module, before downloading the results back to Earth for all to see. A long-term ISS environmental monitoring programme will continue to run these Astro Pi experiments, adding the time-stamped sensor data to downloadable CSV file.

### IoT

These days, we hear the term Internet of Things (or IoT) bandied around quite frequently, and it's often used in association with small, bare-bones computing boards like the Raspberry Pi. But what exactly does IoT mean?



▲ Astro Pi on ISS

The term refers to a network of physical objects, devices, vehicles, buildings or other items that contain embedded electronics, sensors and software. All these objects are able to collect and exchange data across a network – typically the internet. In other words, it's a technology that integrates the physical world with our computer-based systems.

Examples include smart homes and home appliances, smart city infrastructures and services, intelligent and autonomous transportation, even bio-chipped farm animals and a variety of health-related medical implants. This is a fast growing phenomenon, with some estimates suggesting there'll be around 50 billion IoT objects on the planet by 2020.

### IP Address

Every computer has an IP address to identify it on a network. It's important that each network device has its own unique IP address. So on a home network, your Raspberry Pi's IP address has to be different from any PCs, laptops, tablets and smartphones that are also connected to your router.

Once connected to a network, your Raspberry Pi be assigned an IP address. To discover what this address is, on a Pi running Raspbian open a terminal window and type the command 'sudo ifconfig'.

Look at the command output, locate the 'wlan0' entry and make a note of its 'inet addr' value. [mm](#)



# Remembering... Windows XP

## David Hayward looks back at one of the most successful operating systems ever

**T**he operating system that refused to die. Despite being released nearly 15 years ago and Microsoft trying to kill it, Windows XP is still hanging around.

Even after Windows 10 was a month old, Windows XP was still ranked as the third most popular operating system in terms of use. But what made this OS such a popular choice for PC users?

It's a combination of factors that really helped XP cling on to the PC. One was the release of its successor, Windows Vista. Although Vista isn't a bad OS – once you've applied all the updates and such – it didn't really go down too well with the majority of users at the time.

Another factor was that Windows XP was really the last working bridge between legacy and more modern hardware. Not every user has the latest PC and components. Many have some legacy kit they still use to this day, along with the relevant software. Getting that hardware to work correctly under Windows 10 can be a pain, if it works at all. But with Windows XP, and even if this hardware and software was designed to work on Windows 95/98, it still worked. And it worked well.

It was also a remarkably stable operating system, provided you'd built it up yourself and kept it in good order. We can count on one hand the number of times the Blue Screen of Death appeared on our XP machine.

One of the most important factors, though, was that it was still simple. It didn't have an Aero interface, tiles, on-screen dashboards, gadgets and goodness knows whatever advances are present in a more recent OS. It had the desktop, icons and a Start button. And it allowed even the most unknowledgeable users to interact with it easily.

### Its History

Windows XP was released to manufacturing on August 24th 2001, but it was originally one part of two separate products codenamed Neptune and Odyssey.

Odyssey was to be the successor for Windows NT 4.0 and Windows 2000 business users, whereas Neptune was to continue the Windows 98 and ME lineage for consumers. Both projects came across problems within Microsoft itself, with each dropping into development hell at nearly every step of the way. The result was a lot of leftover code and a couple of shelved projects.

Shortly after, Neptune and Odyssey were shelved, and project Whistler came to the forefront. The goal of Whistler was to combine both the consumer and business models into a single operating system, and with it came all the advances that had already been worked on with the Neptune and Odyssey projects.

By June 2001, the Microsoft PR machine was well under way. Madonna's song 'Ray of Light' was being blasted

### Did You Know?

- As of 8th September 2015, there were still 500 million active Windows XP PCs.
- The IRS still used Windows XP, although it's mostly phased out now.
- MS paid Charles O'Rear millions for his 'Bliss' rolling hills image for the XP desktop.
- Due to a hidden folder, you can't create a folder called CON.

out of televisions the world over, and the new experience that was Windows XP was finally being showcased to the public prior to it being made available a couple of months later.

Three Service Packs later and after an extended support period up to 8th April 2014, Microsoft drove the final nail into XP's coffin and ended all support and updates. XP, though, has other thoughts and is still being used on a vast number of PCs, cash machines and other services around the world.

### The Good

A fast, stable and legacy-friendly operating system that worked well.

### The Bad

One of the most targeted OSs for viruses and other malware. [mm](#)



▲ The Windows XP desktop, Bliss

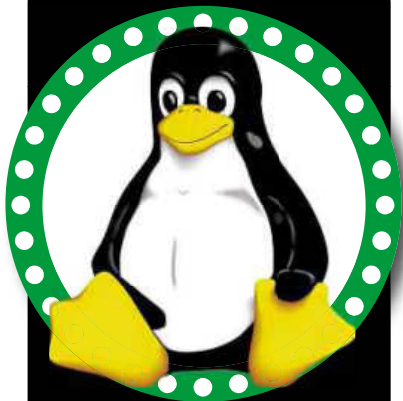


▲ Sadly, XP is no longer supported by MS



▲ Bill Gates at the XP launch





David Hayward has been using Linux since Red Hat 2.0 in schools, businesses and at home, which either makes him very knowledgeable or a glutton for extreme punishment

# Linux

## Windows Subsystem For Linux Overview

### A look at what WSL has to offer

As the time rapidly approaches for the public release of Bash on Ubuntu on Linux, Microsoft has been busy getting the various documentation and surrounding write-ups ready. With mere weeks left now, the Microsoft Developer Portal has recently released the Windows Subsystem for Linux Overview, a sizeable document that covers a lot of background on the project and how it'll work.

According to the Microsoft Developer blog:

"WSL is a collection of components that enables native Linux ELF64 binaries to run on Windows. It contains both user mode and kernel mode components. It is primarily comprised of:

1. User mode session manager service that handles the Linux instance life cycle
2. Pico provider drivers (lxs.sys, lxcore.sys) that emulate a Linux kernel by translating Linux syscalls
3. Pico processes that host the unmodified user mode Linux (e.g. /bin/bash)"

Bash then is called up by the LXSS Manager Service within Windows 10, as a broker to the Linux subsystem driver. This service is used to hold everything together, along with other elements, and is what's used to keep track of the processes within the Bash instance.

Whatever you may think of the entire project, you have to admit that this is pretty clever stuff. One thought that did spring to mind was the resource overhead that the extra service will have on a Windows 10

system? There's no way of knowing yet what the impact would be, since it's still in developer mode, but it'll be interesting to do some benchmarks before and after the system is implemented on a clean Windows 10 machine.

### File System info

The blog then goes on to describe the file system used:

*"File system support in WSL was designed to meet two goals.*

1. Provide an environment that supports the full fidelity of Linux file systems
2. Allow interoperability with drives and files in Windows

*The Windows Subsystem for Linux provides virtual file system support similar to the real Linux kernel. Two file systems are used to provide access to files on the users system: VolFs and DriveFs."*

There's a lot of work going on under the hood here, but it does raise some questions. For one, exactly how similar to the real Linux kernel is the virtual file system going to be? Will it, for instance, be able to handle different processes at once?

And with regards to accessing the Windows file system, what safeguards are in place in case someone accidentally deletes a vital Windows file. Or to expand on that, will any Bash deleted files from the Windows file system be put into the Windows Recycle Bin or will they be gone forever?

There has also been some concern from developers that this could be a flash in the pan project for Microsoft, and that after a while it'll eventually be left to gather dust without any updates. Obviously that'll be a long way off, but if MS hopes users will develop and cross the Windows-to-Linux bridge with Bash under Windows, it's going to have to keep the structure in line with the current developments from the wider world of Linux and the kernel.

The whole Linux under Windows 10 thing is shaping up to be quite an impressive bit of work, and it's something we'll certainly be looking at in more depth as we get to grips with it.

Until next week, folks.

▼ More information regarding Linux under Windows 10 has been released





# Tipping Point

**The Mac experience has always attempted to balance control and convenience, but it doesn't always get things right**

I remember friends trying hard to convince me I was an idiot for liking the Mac during the 1990s. They merrily noted Apple was doomed and that using a Mac was akin to playing with a toy. As far as they were concerned, the command line was king. Even today, there's a perception that Macs are inherently less technical devices than Windows- or Linux-flavoured computers.

Much of this stems from the battle between convenience and control, and the notion that in order to have one of those things, you must compromise the other. Therefore, if you're using a Mac, you may well get a user experience that's relatively fluid and simple for anyone to understand, but everything's going to go horribly wrong the second you need to do anything involved.

I've never really agreed with this line of thinking. I recall frazzled friends complaining about how yet again they'd had to nuke and reinstall their PC, because something or other had hosed the entire system or some piece of hardware had abruptly decided to go off in a huff and ignore everything else around it. I remained baffled when even as Windows improved, people continued banging on about the merits of a command-line interface, presumably thinking they were immersed in *The Matrix*, typing thousands of words per minute while glowing green characters raced before their eyes. My Macs had their moments, naturally, but for the most part sat there in their 'toy like' glory, enabling me to get on and do things, rather than demanding constant and time-consuming maintenance.

There is, however, a tipping point for everyone regarding compromise, and I think I've reached mine on the Mac due to a combination of software release systems and automatic updates. I'm old enough to remember when a common means of updating software was through a shiny disc taped to a magazine. You'd scour release notes, get excited about new features, and ignore the fact the disc was compiled months ago and so a new version of the software was probably available via that fascinating (yet inaccessible to the masses) thing called 'the internet'.

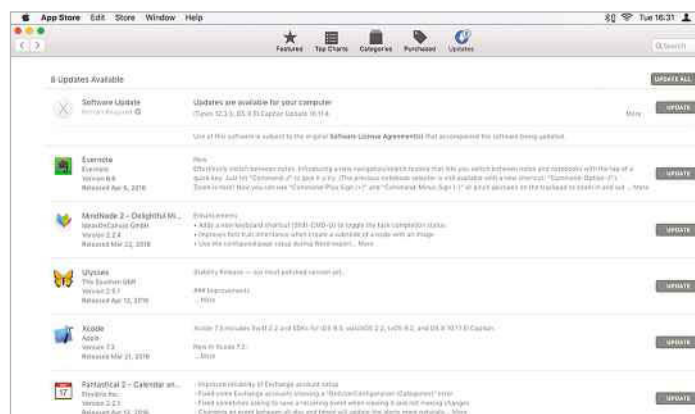
Soon enough, though, everyone was connected, updates came thick and fast, and we got to the point where even clicking a button became too much effort. Now, devices automatically update software, without you lifting a finger, which is convenient. The nagging problem is a massive loss of control.

Subscription-based software is all about the current version, and although Apple's Mac App Store typically has a 'pay once' mentality, even it isn't interested in anything prior to the very latest release. That's fine when things go well, but a horror show when problems occur. And this needn't

be anything particularly catastrophic, such as apps failing to launch or merrily obliterating a hard drive. For example, I recently discovered two writing apps I favour decided to start supporting MultiMarkdown's table of contents feature. I'd not spotted the tiny mention of this buried in update notes. Now, when exporting Markdown to HTML, loads of cruft goes along for the ride. I'm having to paste between different apps or manually delete bits I don't want.

In other words, the convenience of automatic updates has now left me in a situation where I have less time, because updates automatically applied added new features that cannot be removed, and there's no way to downgrade the apps. So I'm now manually clicking update buttons again, more carefully reading release notes and cursing developers who add new features on a whim without considering the ramifications of doing so. I'm stopping short of deciding my 1990s friends were right, though; living in the command line is a step too far.

▼ **Update all? No chance. Even individual update buttons won't be clicked until release notes are read**



**Craig Grannell is a writer, designer, occasional musician and permanent loudmouth. He's owned Macs since 1996, when Apple was facing certain doom, and is therefore pleasantly surprised by its current success. Find Craig on Twitter at @craiggrannell**

# Mac





Ian is a professional IT analyst, a semi-professional writer and a pretty amateur electronic musician. He likes gadgetry and loves making gadgets do things they were never designed to do

# Mobile

# Apple TV 6 Months On

**Ian McGurran got an Apple TV six months ago. How's he getting on with it?**

**T**he Apple TV, Apple's little box that hasn't. Yes, despite being on the right track some time ahead of every service and its dog having or being on a tiny media playing box, the Apple TV has struggled to gain ground in the UK. Mostly, this was because unless you literally purchased all your media from iTunes, it wasn't that good. There were precious few applications built into it, and if you wanted to play anything other than Apple-approved content, you had to iOS jailbreak it. Apple did listen, though, and six months ago it released the fourth version of the unit, and the first major update: this was the first Apple TV with... built in memory. Just kidding, it was apps (and memory, technically). With the iOS-based tvOS platform bursting with software, this looked like the ATV4 could finally be the best of both worlds: TV box and iOS device. Is it?

In our house, we have been media player curious for many years, from media centre PCs a decade ago to Xbox 360 extenders and WDTV hacking – it's all been done. Recently, the media player of choice has been a hacked Now TV box, as I was told media boxes need to be more other half friendly – preferably easy to use and not require hacking or network faffing. While the Now TV was okay, it wasn't powerful, nor did it have Netflix. When the Apple TV appeared, it offered a recognised name, an easy UI and, on release, both Netflix and Now TV. Plus there was the BBC

iPlayer, YouTube and a clutch of fun games, but mostly there was the promise of more to come.

Six months later we still have Netflix, Now TV, BBC iPlayer, YouTube and... well, that's it. Still. What's more, the iPlayer for tvOS is lacking, mostly due to having to conform to the tvOS layout. But no 4OD, Demand 5 or ITV Player. The lack of Amazon Video is less unexpected, but annoying all the less. Luckily, Plex and VLC are available, meaning you can at least get access to your own media without jumping through a ton of hoops, though again the interface is dictated by tvOS (here it's not too annoying).

Games and other apps have been an interesting distraction, with some genuinely fun titles on the platform, such as *Lumino City*, *Alto's Adventure* and *Oceanhorn*. The problem here is not that they are difficult to play with the remote; they're not bad at all, though it's no joypad. No, the problem is that they were launch titles, and while the amount of subsequent releases has been reasonable, very few have lived up to their quality. You rarely find some of the more successful titles or big name games coming to the ATV4, or if they do, it's a long time after their standard iOS release. The rest of the titles are frankly not much better than smart TV padding apps.

Talking of the remote, other than its attractive design, it isn't living room or low-light friendly. The

touchpad is over sensitive, meaning just a brush can mean you're 15 minutes forward in your film. It's difficult to use without looking at it too; it feels the same either way up, so you frequently hit the wrong button and exit applications. It's black too, so you can see the symbols in low light, and fumbling for the concave button often results in brushing the touchpad.

Apple won't give up on the Apple TV hardware or the tvOS platform, but being six months in and still not having three of the basic terrestrial VOD apps – apps already on the iOS platform – does not bode well at all. Were the ATV4 a console, owners would be wondering if it has been abandoned. That we still have to put on the Now TV box – a box a tenth of the price – to watch them is a pretty poor show. It hasn't been sold yet, but with the thrill of apps unfulfilled, the Fire TV stick is looking increasingly more attractive.





# Intel Inside The Classroom

**Andrew Unsworth says teachers are assisted by some great technologies**

I've spent the last few weeks covering the use of computer technology in education, and I want to continue that for this week's column. It may not be hardware exactly, but a few months ago, Intel announced something called the Intel Learning Studio. This is a tool that seeks to help teachers improve the learning of their charges through the use of gaming or 'gamification' to borrow the exact term used by Intel. Gamification is a horrible word, but much like 'selfie', it's become part of the modern lexicon, so I apologise in advance for using it.

Back to Intel Learning Studio: Intel has teamed up with Arizona State University and Professor Sasha Barab of the Center for Games and Impact to produce a platform for teachers that teaches them how to use gamification to enhance the education of their pupils. Intel's press release ([tinyurl.com/gwkubvh](http://tinyurl.com/gwkubvh)) says "The demand for gamification and game-infused learning methods is growing", and that the Intel Learning Studio platform's lessons "are designed for inquiry-based teaching and learning, and will give teachers the resources and information to develop collaboration, problem-solving and inquisitive learning in a playful way in the classroom."

I'm sceptical by nature, and I have my reservations about the Intel Learning Studio, but I understand the intuition behind it, and if Intel's approach can instil a desire to seek knowledge in pupils, then that's a good thing. If you're a teacher who has

used Intel Learning Studio, please write in and let us know what you think of it.

## Virtual Learning Environment

Although the Intel Learning Studio is designed to be used by teachers as part of their ongoing professional development, I can't help but be reminded of a classroom tool that first started to make headway in schools (or my school at least) around nine years ago in 2007. The tool in question is the virtual learning environment (VLE), and it's a type of server-based software that allows teachers to design and create virtual lessons that pupils can access from computers at home or at school. These lessons can contain images, hyperlinks, text, radio buttons and all sorts of other components to create engaging lessons, and especially for creating homework.

There was some hostility towards such systems infiltrating the classroom at my school, but to be fair VLEs must have seemed threatening to those who didn't 'get on' with modern technology. As with any new technology,

learning how to use a VLE requires an initial investment of time and energy to understand it and become proficient in its use, but once that investment has been made, the benefits can be tapped and the skills transferred to other VLEs.

I think it's also worth pointing out that virtual learning environments aren't a replacement for the teacher or good, effective teaching skills. The material provided by teachers through virtual learning environments is analogous to the photocopied tests and handouts given to those of us educated in the 80s and 90s, except that VLEs allow greater interaction and support for teachers and pupils.

That's it for educational technology, for the present time at least. I hope the last few weeks have been interesting. I haven't been able to cram as much detail into the 600-or-so word limit of this column as I would've liked, but hopefully it's given some food for thought and some hope and reassurance that computer technology is improving the education of this and future generations of schoolchildren.



Andrew Unsworth has been writing about technology for several years, he's handy with a spanner, and his handshaking skills are second to none

# Hardware







Ryan Lambie has loved videogames since he first stared up in awe at a *Galaxian* arcade cabinet in his local chip shop. 28 years on, Ryan writes about gaming for Micro Mart. He's still addicted to chips and still useless at *Galaxian*

# Gaming

## Future Shock

Devolver has released some of the best indie games of the past few years, and its future offerings, which include the cyberpunk shooter *Ruiner*, look just as good

**RUINER**

This week, Ryan checks out some of the forthcoming games from Devolver Digital, and takes a look at how Blizzard's Project Titan gave rise to Overwatch...

### Plug & Play

In the space of just seven years, Devolver Digital has established itself as one of the industry's best independent publishers. Picking up games from such diverse places as Croatia, Sweden and Japan, Devolver has an eye for vibrant, creative games in all kinds of genres. Starting with the *Serious Sam HD* games in 2009, the firm grabbed plenty of attention with the violent and wildly addictive top-down shooter *Hotline Miami*. The product of a tiny core team of two designers, the game's glowing reviews and widespread press coverage belied its humble origins. Other great games picked up by Devolver have so far included the disturbing point-and-click adventure *Gods Will Be Watching*, bonkers dating simulator *Hatoful Boyfriend* and the cerebral, eerie first-person puzzler *The Talos Principle*.

Devolver's eclectic taste is just as in evidence in its other forthcoming releases. First, there's *Ruiner*, the debut title from Polish studio Reikon – a team composed of veterans from such games as *Witcher*

2 and *Dying Light*. Inspired by such cyberpunk touchstones as *Blade Runner*, *Akira* and *Neuromancer*, *Ruiner* is an isometric shooter set in a dark future city of gleaming towers and garish neon signs. Casting the player as a masked, impossibly agile assassin fighting a shady outfit called *Heaven*, it's a hectic-looking blaster in the mould of *Dead Nation* or *Hyper Light Drifter*. From the little we've seen so far, *Ruiner*'s depiction of a dystopian cyber-city looks quite stunning. Like Bulldog's classic *Syndicate*, *Ruiner* provides the illusion of a metropolis, which goes about its business independently of the player – until, that is, the gun-blazing, sword-swinging action kicks in, and all hell breaks loose.

We don't yet know what else – if anything – *Ruiner* will bring besides its action. Light RPG elements, perhaps? Hacking mini-games? Whatever Reikon's game will entail, its fleet-footed mayhem has already grabbed our attention.

Looking further ahead, Devolver has *Strafe* lined up, a first-person shooter directly inspired by the likes of *Doom*

and *Quake*. First announced last year, *Strafe* was amusingly described by its creator as "the goriest shooter of 1996," which provides a suggestion of the kind of retro, pared-back action we can expect. Its graphics are blocky and its AI simple, but like those shooters of old, *Strafe* is sold on its pace, flow and dramatic showers of pixellated gibs.

Continuing the retro theme, Devolver also has *Mother Russia Bleeds* lined up. If you can imagine what it would be like if the makers of *Hotline Miami* made a side-scrolling brawler in the vein of *Double Dragon* or *Final Fight*, you'll have some idea of the grimy, gratuitous (and not entirely serious) combat coming up here. A stage presented at last year's E3 shows the player punching and kicking their way into a nightclub; the gameplay doesn't exactly look strategic, but like the arcade hits *Mother Russia Bleeds* references, it should be perfect for short, sharp bursts of old-school fun.

*Ruiner* and *Mother Russia Bleeds* are both due out in 2016, with *Strafe* scheduled for 2017.





▲ Blizzard's MMORPG Project Titan "failed horribly", designer Jeff Kaplan says. Fortunately, it gave rise to the far less horrific shooter Overwatch

## Online

After years in development, Blizzard's eagerly awaited first-person shooter *Overwatch* launches later this month.

As longtime readers of these pages will know, the game's history has already been a long and unusual one: *Overwatch* emerged from the ashes of *Project Titan*, an MMORPG that many speculated would be the successor to *World Of Warcraft*. The top-secret project was in the works for at least seven years before its abrupt cancellation in 2014; at the time, all Blizzard boss Mike Morhaime would say was, "We didn't find the fun."

In an April interview with Gamespot, however, designer Jeff Kaplan opened up a little more about *Titan* and how its failure ultimately led to the very different *Overwatch*. According to Kaplan, *Titan* "failed horribly in every way a project can fail" – despite the best efforts of some of Blizzard's most talented designers.

"You had these people who either came from other companies or from within Blizzard," Kaplan continued, "and were used to working on games that were very successful like a *World Of Warcraft*, for example. To go through such a complete and utter failure is very hard for people who are used to experiencing success."

When the plug was ultimately pulled on *Titan* – leaving the team with "the smoking pile of a cancelled project", as Kaplan puts it – the pressure was on to create a success out of that failure.

"We saw it as a last chance," Kaplan continued. "We use the phrase often, 'You're only as good as your last game,' so you don't get big headed [...] my most recent game was an utter failure called *Titan* that got cancelled."

Work on *Overwatch* began as a result, a game that, although very different from the MMORPG Kaplan was originally overseeing,

nevertheless shares some similarities. The studio's story developer, Chris Metzen, admitted as much at BlizzCon in 2014, when he said that the two projects share certain elements in common, with *Overwatch* reusing some of *Titan*'s map designs.

*Overwatch* was Kaplan and his team's attempt to make "something really fun," and the reaction to the game so far suggests they've hit that target – no mean feat, given that it's Blizzard's first foray into FPS territory. Meanwhile, we can't help wondering what *Titan* was like and why it was cancelled after so many years of work was put into it. At one time, a Blizzard executive said that *Titan* would "blow people's minds". Now, it looks as though this once huge project will remain forever under lock and key.

*Overwatch* launches on 24th May.

## Incoming

*Pang* was one of those games that seemed a bit quaint

even when it first came out. Released in 1989, it was a single-screen shooter that pitched one or two players against an army of giant bubbles. The aim was to blast the bubbles with a strange gun that resembled a grappling hook; the weapon required careful aim and expert timing, since its projectile moved slowly and took time to reload. Far more entertaining than it sounds, *Pang* was widely ported to home computers and consoles, and became a fondly remembered hit.

Thanks to DotEmu and Pastagames, the bubble-blasters is back with *Pang Adventures*. Once again a frothy mix of *Space Invaders* and *Asteroids*, it really comes to life when a second player joins the fray. Younger readers will probably scowl at it; for those who remember the original game, *Pang Adventures* may just trigger a wave of misty-eyed nostalgia.

*Pang Adventures* is available now from Steam.



▲ The 80s bubble-bursting action game *Pang* is making a welcome return. *Pang Adventures* is available now on Steam, and looks just as colourful as ever



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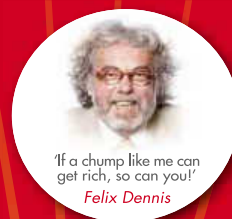
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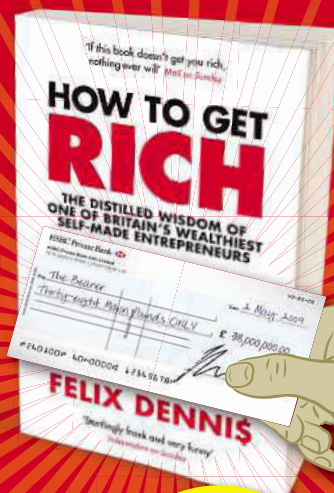
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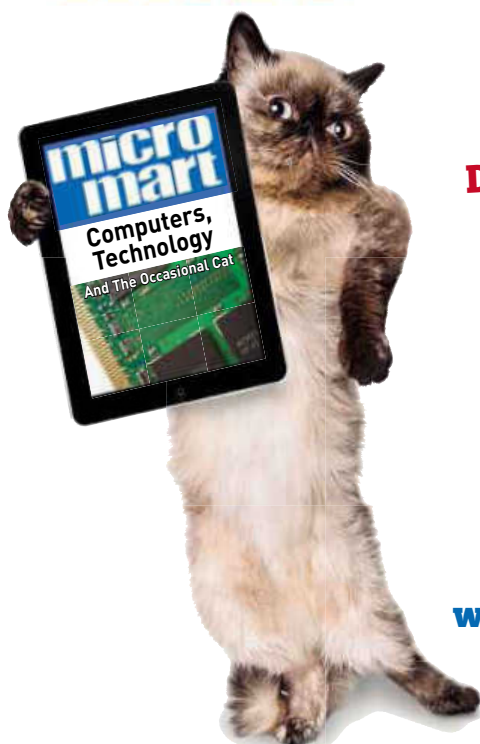
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**WANTED:** PC Tower case (beige colour if possible) to rehome an Amiga A1200 vintage computer. The Amiga motherboard is H 410mm x L 190mm (H 16" x L 7.5"). PSU not an issue but if available 250 watt more than enough.  
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# ASK AARON



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Please try to keep your queries brief and limit them to just one question per letter, simply so we can squeeze in as many as we can each week. Please include relevant technical information too.

*Aaron*

## Bitdefender Free?

I've read in your magazine that Bitdefender is free for home use, as well as being a very good antivirus application. As I ran into problems with my previous antivirus application (AVG), I decided to take your advice and downloaded Bitdefender to try.

I installed it, and have been using it for a while. Initially, I agreed with you and found the program to be very good. It seemed to offer good protection and stopped a few threats to my system – and it didn't interfere with other apps, remaining mostly silent. It also didn't slow my system down as much as others.

Then I ran into a problem that contradicted your advice. The program stopped working and Windows warned me that I had no antivirus protection. I opened up Bitdefender which said it was deactivated and needed me to sign up for a Bitdefender account. I do not want to do this, as I wanted a free antivirus application, which you said this was.

Why did you inform readers that Bitdefender is free when it's not? I'm left without a decent antivirus program now, and am not sure which alternative to try, and if they'll actually be free.

**Graham**

*Thanks for your question Graham. While I apologise for any misunderstanding here, we were correct with regard to Bitdefender's free status. The program itself is free but, like many other similar programs (including another that we recommend, Avast), you are required to register and create an account to use it in the long term. This doesn't cost any money, and although it's worded in the program in a way that suggests the need to spend money, this isn't the case.*

*The program can be used for a limited time without registration, but after this, it'll*

*lock until you create an account. Once you do this, the program will work again as normal – again, I reiterate that no money needs to change hands.*

*If you still have the program installed, simply follow the link in the program's interface and*

*with Bitdefender going forward, you may want to try the aforementioned Avast, as this is a good free security app. Be aware, however, that you need to register to use that program too, but it costs no money. This registration*

**“ We were correct with regard to Bitdefender's free status. The program itself is free ”**

*register. Once you're done, Windows won't worry about a lack of protection any more, and Bitdefender will operate as normal. If, for some reason, you decide not to continue*

*has to be renewed each year, but that's free too.*

▼ *Bitdefender's free edition is just that, but you need to register for an account*





## Cyclic And Redundant

I've been experiencing problems reading discs on my PC. It's not happening to one disc, but several, and each time it happens I get a cyclic redundancy error message. I've never seen this error before, and have no idea what it means. Well, aside from it preventing me from using my discs.

Can you tell me what this error means, and how I can fix it? I'd like to be able to use my discs, as some of them are great older games I miss playing.

**Pete**

This is an error I've not seen for a long time, and it can relate to both optical and internal storage. The full name is Cyclic Redundancy Check, or CRC for short, and it's a data verification method used to check the integrity of data. Basically, it means that the expected data cannot be read into memory, and Windows is unable to continue the operation it's performing. In your case, this is reading data from the discs. During the read operation, the raw data is unable to be read or be validated properly, prompting the error. Fixing it can be easy in some instances, but in others it's difficult, and may require the purchase of new hardware.

You mention that not one, but several discs are prompting the error, which would point to either a big coincidence, or a problem with your disc drive. A common cause of the issue that's easily solved is dirt build up on the disc, and a good clean can help. A disc may also be scratched, so fixing it may not be quite as easy, but a simple clean could help if the scratches aren't too severe. If the scratch is too deep, though, the disc may need professional repair, or replacement.

*With multiple discs experiencing the issue, I suspect your problem lies with your actual disc drive. It could be the laser of the drive that's at fault, either because of dirt or malfunction. You could try a disc drive cleaner, or, if you're not worried about tinkering, you could open the drive up and use some cleaning fluid on a cotton bud to clean the laser manually. Always be very gentle when doing this, though.*

*Failing this, the drive itself could be faulty, and you may need to replace it. If you have a spare, fit this and give it a go, or simply try the discs you wish to use in another PC. You can buy new disc drives for a very low price these days, and a quick look online will net you many different models.*

*If any readers are getting the error when using hard disks, the same kind of fixes apply, although cleaning a hard disk isn't something you can easily do, at least not without damaging the hardware. However, there is a software tool you can use that may help, and this is CHKDSK, short for Check Disk.*

*To use this, right-click the drive in question and select Properties > Tools > Error Checking > Check Now. Run an advanced scan and let it go. It could take a while, depending on the size of the drive. Scanning the main OS drive will need a reboot. You can also run CHKDSK from the command prompt. To do this, open up a command prompt and type 'chkdsk /f C:' replacing C with another drive letter if needed.*

*When the scan is finished you'll be given a report, and if able, CHKDSK will fix the errors. If it cannot fix these, the damage may be too great, and you may be out of luck. You could try third party tools, but be aware that any physical damage is unlikely to be fixed by software, so don't expect miracles.*

▼ Check disk is a useful Windows tool that can help find and fix errors

```
Administrator: Command Prompt
2012-02-06 03:42:55.912 Deleting index entry A54836~1.INF in index $I30 of file 180940.
2012-02-06 03:47:13.624 Deleting index entry B4B2C5~1 in index $I30 of file 182301.
2012-02-06 03:47:13.640 Deleting index entry B4B2C5~1.INF in index $I30 of file 182301.
2012-02-06 03:47:31.097 Deleting index entry 059b119b30591f6902711e8ec3cee0b1c4c6244a9d1c.info in index $I30 of file 182426.
2012-02-06 03:56:27.379 Deleting index entry DC7633~1 in index $I30 of file 185250.
2012-02-06 04:03:04.774 Deleting index entry 07CF47~1.INF in index $I30 of file 187564.
2012-02-06 04:06:01.896 Deleting index entry 2f87f5c44e157b75c59aa05e1f45d0fc648c5d739a7e.info in index $I30 of file 188578.
2012-02-06 04:06:01.912 Deleting index entry 2F87F5~1 in index $I30 of file 188578.
2012-02-06 04:06:01.928 Deleting index entry 2F87F5~1.INF in index $I30 of file 188578.
2012-02-06 04:12:53.456 Deleting index entry 261ae413d3c906d4f5ed7495305e753d25385a94a99f in index $I30 of file 190913.
2012-02-06 04:12:53.456 Deleting index entry 2610E4~1 in index $I30 of file 190913.
2012-02-06 04:15:29.145 Deleting index entry C4E1E5~1.INF in index $I30 of file 191692.
2012-02-06 04:16:02.451 Deleting index entry ff3238e645a11587b136493fffc53b1a21b635268b577 in index $I30 of file 191933.
2012-02-06 04:16:02.482 Deleting index entry ff3238e645a11587b136493fffc53b1a21b635268b577.info in index $I30 of file 191933.
2012-02-06 04:16:02.482 Deleting index entry FF3238~1 in index $I30 of file 191933.
2012-02-06 04:16:34.181 Deleting index entry 488261391cda8114bf4062a3f2ec67e181695cac4fa in index $I30 of file 192077.
2012-02-06 04:16:34.212 Deleting index entry 488261~1 in index $I30 of file 192077.
2012-02-06 04:16:34.228 Deleting index entry 488261~1.INF in index $I30 of file 192077.
2012-02-06 04:32:23.692 Deleting index entry 3b4bf584bb909173b28e969f4afe4b330173ebf931cc in index $I30 of file 197494.
2012-02-06 04:32:23.724 Deleting index entry 3b4bf584bb909173b28e969f4afe4b330173ebf931cc.info in index $I30 of file 197494.
2012-02-06 04:32:23.724 Deleting index entry 3B4BF5~1 in index $I30 of file 197494.
2012-02-06 04:34:35.481 Deleting index entry C5FEE2~1.INF in index $I30 of file 198083.
2012-02-06 04:36:42.604 Deleting index entry 92d7f785a073f6a5118d630f49d8d3faeb1c6972de16 in index $I30 of file 198857.
2012-02-06 04:36:42.700 Deleting index entry 92d7f785a073f6a5118d630f49d8d3faeb1c6972de16.info in index $I30 of file 198857.
2012-02-06 04:36:42.700 Deleting index entry 92D7F7~1 in index $I30 of file 198857.
2012-02-06 04:36:42.700 Deleting index entry 92D7F7~1.INF in index $I30 of file 198857.
2012-02-06 04:40:41.302 Deleting index entry ff7eedc03c0490525d7cfb5e9d3bd7507chf725035e2 in index $I30 of file 200270.
2012-02-06 04:40:41.318 Deleting index entry FF7EED~1 in index $I30 of file 200270.
2012-02-06 04:40:48.182 Deleting index entry 486cea8bb6208752b80167b4705f534c996e156a8b83.info in index $I30 of file 200310.
2012-02-06 04:46:32.287 Deleting index entry D5D9DD~1.INF in index $I30 of file 202350.
2012-02-06 04:50:30.718 Deleting index entry 7E4643~1.INF in index $I30 of file 203874.
2012-02-06 04:55:16.588 Deleting index entry 713aa14bd083fed8514089d1d81d66d2a31c0b105f6a in index $I30 of file 205516.
2012-02-06 04:55:16.588 Deleting index entry 713AA1~1 in index $I30 of file 205516.
2012-02-06 04:58:35.660 Deleting index entry 610b4c61e962f4a8386c0dfc9f3500f9dc1e215f0c79 in index $I30 of file 206640.
2012-02-06 04:58:35.660 Deleting index entry 610b4c61e962f4a8386c0dfc9f3500f9dc1e215f0c79.info in index $I30 of file 206640.
2012-02-06 04:58:35.676 Deleting index entry 610B4C~1 in index $I30 of file 206640.
2012-02-06 04:58:35.676 Deleting index entry 610B4C~1.INF in index $I30 of file 206640.
2012-02-06 05:10:41.623 Deleting index entry bcb10856f5e7eac261b540cf3d3becf7bdceb1095adbe in index $I30 of file 211220.
2012-02-06 05:10:41.639 Deleting index entry bcb10856f5e7eac261b540cf3d3becf7bdceb1095adbe.info in index $I30 of file 211220.
2012-02-06 05:10:41.639 Deleting index entry BCB108~1 in index $I30 of file 211220.
2012-02-06 05:19:51.633 Deleting index entry cd179162747ca11b0184f270c6de20202eb8955ab224 in index $I30 of file 214521.
2012-02-06 05:19:51.649 Deleting index entry cd179162747ca11b0184f270c6de20202eb8955ab224.info in index $I30 of file 214521.
2012-02-06 05:19:51.665 Deleting index entry CD1791~1 in index $I30 of file 214521.
2012-02-06 05:19:51.665 Deleting index entry CD1791~1.INF in index $I30 of file 214521.
2012-02-06 05:23:10.924 Deleting index entry 99157b7d6119d4c2f0421f8ad8fa692ab9ce3f50537b in index $I30 of file 215761.
2012-02-06 05:23:10.924 Deleting index entry 99157B~1 in index $I30 of file 215761.
2012-02-06 05:26:43.599 Deleting index entry ef7c09ef7f7b81ealc02725dafb2d63fd2d4125d0afee in index $I30 of file 217280.
2012-02-06 05:26:43.615 Deleting index entry ef7c09ef7f7b81ealc02725dafb2d63fd2d4125d0afee.info in index $I30 of file 217280.
2012-02-06 05:26:43.630 Deleting index entry EF7C09~1 in index $I30 of file 217280.
2012-02-06 05:29:58.833 Deleting index entry 6BAC28~1.INF in index $I30 of file 218492.
```



# ASK JASON



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jason@micromart.co.uk

While we try to cover as many questions as we can, we regret that Jason cannot answer your questions personally, but he'll cover as many as he possibly can each week. Please ask one question per letter and remember to include the full specification of your computer, including its operating system.

Jason

## Access Denied?

My MacBook Pro has died. It dates from 2007, so I can hardly complain, I guess. For its replacement I've gone to the dark side and bought a cheap laptop running Windows 10, but now I'm faced with retrieving my data from the Apple machine's hard drive. I'd not considered that this would be a problem, but Windows doesn't recognise the drive at all. How can I access it?

**Brad, Gmail**

*OS X uses the HFS+ file system (typically), not NTFS or FAT32, so ordinarily Windows hasn't a clue what to do with it. What you're after is a tool that'll act as a go-between. In my view, by far the best is Paragon HFS+ for Windows. It's one of those very rare tools that, without any fuss, frills or fanfare, does exactly what it's supposed to.*

*For starters, there's no kludgy, unintuitive, reinventing-the-wheel file manager. Paragon's software simply hooks into Windows' own File Explorer (or*

*Windows Explorer). You'll get a drive letter, Brad, just as normal. Both reading and writing 'just work', even from within other programs. You'll completely forget you're accessing a non-native drive. The software's fast, compatible with XP onwards, and even supports GPT drives, not just traditional MBR drives. It's a beautiful thing.*

*Beauty usually comes at a price, of course, and so it proves here. HFS+ for Windows costs \$19.95 (a little under £14). However, there's a trial that lasts ten days. No limitations. No catches. I imagine you only want to back up a few folders, so you'll probably not even need ten hours. Here's the link: [goo.gl/CIEPxL](http://goo.gl/CIEPxL).*

*If you do need more time, consider HFSExplorer: [goo.gl/iaMCWN](http://goo.gl/iaMCWN). This only offers read access, but to be fair, writing to the HFS+ drive isn't on the agenda in your case. All you need to do is copy the relevant data and write it to your Windows drive. Unlike HFS+ for Windows, however, HFSExplorer does launch its own file manager (the drive won't be inaccessible in any other program). It's a nasty-looking thing. Operation is pretty sluggish too, largely because the program's written in Java. There's one big positive, though: it's gratis.*

▼ How easy is it to access Apple HFS+ drives in Windows?



## A Bit Of TLC

I own a Toshiba Satellite C850-1MC laptop. It works well enough but isn't the nippiest of things, so I want to fit an SSD in place of the spinner. I'm considering the 240GB Toshiba Q300, available for under £50. The spinner is a 500GB unit, but about 350GB is still empty, so a 240GB SSD should be enough. I've been advised, though, that the Q300 is TLC-based – whatever that means – and should be avoided. What are your thoughts?

**J Cook, Kent**

*Yes, the Toshiba Q300 range is TLC-based. But as you say, what does that mean? Well, the NAND flash used in SSDs comes in three flavours. With SLC or single-level-cell NAND, each cell stores just one bit of data. We're talking binary, so the bit can be either 'on' or 'off', storing either 0 (0) or 1 (1). With MLC or multi-level-cell NAND, each cell stores two bits of data. This leads to 00 (0), 01 (1), 10 (2), or 11 (3). And then there's TLC or triple-level-cell NAND, where each cell stores (wait for it!) three bits of data, granting 000 (0), 001 (1), 010 (2), 011 (3), 100 (4), 101 (5), 110 (6), or 111 (7).*

*For any given capacity, an MLC drive requires only half as many cells as an SLC drive, and a TLC drive drops this to a third (or two-thirds as many as an MLC drive). Clearly, manufacturers can use MLC and TLC technologies to offer big capacities at reasonable prices or mainstream capacities at dirt-cheap prices. MLC technology is the single reason why SSDs took off with end-users in the first place, and TLC technology is why SSDs can now be found even in bargain-bucket products.*

*As ever, there are downsides. In general, the higher the bit-density, the lower the durability. NAND cells can only handle a certain number of program/erase or P/E cycles – write cycles – before packing up. Broadly, SLC cells are good for about 100,000 cycles, MLC cells for about 3,000–10,000, and TLC drives for about 1,000.*

*SLC drives are intended for server-type use, where huge quantities of data will be written on a daily basis. They're expensive and often low-capacity. High-end consumer drives are MLC-based, while drives on the bottom rung tend to be TLC-based. There are also enterprise MLC or eMLC drives, which use MLC cells rated for 20,000–30,000 P/E cycles.*



Does this mean TLC drives are prone to early failure? No. Wear-levelling algorithms ensure no cells are written to significantly more than any others, and most of the activity on consumer SSDs is reading, not writing. Reading doesn't impact on lifespan. It's estimated that a 240GB TLC-based SSD sustaining 10GB of writes per day – far more than most of us will rack up – should last for over 20 years (smaller capacities tend to have shorter lifespans). Worry not!

The other factor is performance, of course. In theory, SLC-based drives are the fastest, though many focus on reliability rather than speed. On paper, the specs of TLC drives often look similar to those of MLC drives, but the reality is usually a different story. Consider the specs below.

#### 240GB Toshiba Q300 (TLC)

Sequential read: 550MB/s

Sequential write: 520MB/s

Random read (4KB, QD32): 86,000 IOPS

Random write (4KB, QD32): 73,000 IOPS

#### 256GB Samsung 850 Pro (MLC)

Sequential read: 550MB/s

Sequential write: 520MB/s

Random read (4KB, QD32): 100,000

Random write (4KB, QD32): 90,000

Now look at this review on AnandTech: [goo.gl/YLzRhs](http://goo.gl/YLzRhs). The 850 Pro is a best-



▲ The only TLC-based SSDs that match the performance of MLC-based SSDs are Samsung's Evo models (and the prices reflect this, sadly)

in-class affair and turns in real-world numbers pretty close to those advertised. The Q300, on the other hand, is only half as good at best (especially when writing for long periods).

Does this mean you should give the Q300 range a wide berth? Not a bit of it. You'll still be getting performance far in excess of any spinner, and reliability-wise Toshiba SSDs are proving to be rock-solid (as are

OCZ drives, now that Toshiba has taken OCZ over). For under £50, the 240GB model is a steal. Just be aware of what you're buying. Would the 256GB 850 Pro give you a better experience? Well, possibly, marginally. Is it worth more than double the money? For most users, I'd suggest not.

Note – Toshiba's Q300 Pro range is MLC-based. The 256GB model costs around £90.

## Slots Of Fun

I'd like to upgrade the small-form-factor PC I built a couple of years ago. It's got a mini-ITX MSI C847IS-P33, 4GB of DDR3, and a soldered Celeron 847. It's also got a PCIe x1 graphics slot. And that's the rub, as I want to do a bit of gaming. Can I fit a graphics card? Do PCIe x1 cards exist?

**Alex Collins, Gmail**

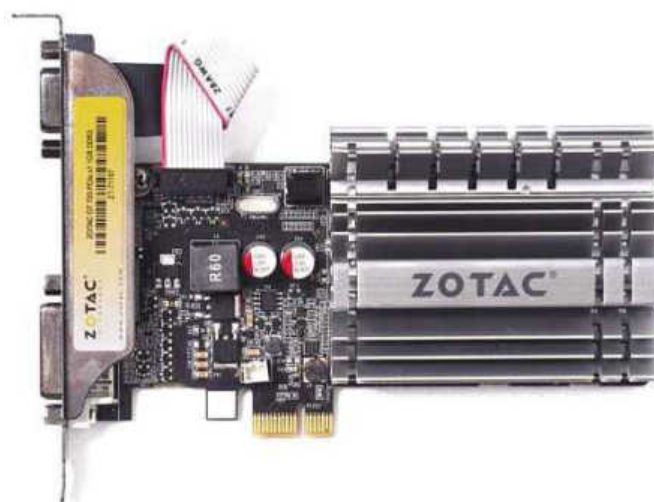
Yes, you can fit a graphics card, Alex. I could be wrong, but I think the fastest PCIe x1 model available is Zotac's 1GB GeForce GT 730 (PCIe 2.x). It's not exactly popular, but it's currently listed on Amazon, priced at around £55. That's pretty competitive with 'normal' GT 730s.

I can't give any guarantee about performance, but you may find this test at TechPowerUp rather illuminating: [goo.gl/oLihN9](http://goo.gl/oLihN9). Here, a GeForce GTX 980 is run over PCIe 1.x, 2.x, and 3.x and at x16, x8, and x4. In most games, there's only a marginal difference in performance across the whole lot and, at worst, in some recent titles at 4K, the PCIe 1.x x4 configuration falls away only by around 25%. Astonishing.

Now, your MSI's PCIe 2.x x1 slot provides half the bandwidth of a PCIe 1.x x4 slot, but that may not matter – the GT 730 is hardly a speed demon to begin with. And your Celeron 847 might prove a bottleneck. Yes, it's a dual-core Sandy Bridge affair, but at 1.1GHz it's a bit of a sloth. Sorry! Would a GT 730 give you better numbers than the built-

in HD Graphics? Definitely. Would you be able to game? Yes, but only at modest settings. Only you know whether that's good enough or whether you'd be better off building a new PC.

▼ What on earth is it?





# Crowdfunding Corner

**Portability is the way computing and its accessories are going now, so it's always good if hardware is wireless – and whether that's a battery charger or a pair of headphones, Kickstarter can help you**

## Jiffy Charger

Charging devices isn't always easy at short notice. Remembering to carry a battery pack can help, but you don't always have the time or foresight to charge that in advance. Solar chargers are a nice idea, but in the UK they're not normally much help. So what about this alternative?

The Jiffy charger is a wind-up power bank which you can charge by turning the handle. It's completely energy independent design means you can charge anywhere, at any time, as long as you've got the ability to turn the handle. It's unrestricted by temperature or altitude, and while its USB port allows it compatibility with a huge number of devices already, the multi-USB cable comes with 10 different connectors, so you don't even have to remember the appropriate leads for your device. All that, and a USB add-on can turn it into a handy LED-based light source in an emergency.

The charger itself can be received by backing just €25 (£19.50) while the LED torch and multi-USB cable add on both cost €5 (£3.80) each. You can even receive a discount by backing €45 (£35) for two Jiffy chargers! Everything is aiming to ship in August 2016, assuming the target of €25,000 (£19,500) is met by the start date. Things look promising.

**URL:** [kck.st/1VUuJ0d](http://kck.st/1VUuJ0d)

**Funding Ends:** Friday, 20th May 2016



## Truu Earbuds

The way wireless technology has improved means it's now possible to fit both wireless charging and wireless receivers into a unit the size of an earbud. At least that's what Truu promises. So, if you want headphones that are virtually impossible to see, don't give away the fact you have a phone on your person and can't get yanked out by mistake, these might be exactly what you need.

With built-in Bluetooth and a wireless charging cradle that only requires them to be placed on it, these earbuds need never see a cable. When not in use, the buds connect to one another using grade N52 magnets, so you won't lose time searching for them both. Memory foam tips ensure a comfort-led fit for any ear. The battery lasts for five hours of play time, and one even has a built-in bone-conducting microphone so they can be used as a wireless speakerphone.

If you're quick enough you might be able to get a pair of Truu earbuds for €150 (£116), but there should still be pairs available at slightly the less discounted levels of €170 (£132) and €200 (£155) even if you miss those – the projected retail price is €250 (£194). An expensive deal for headphones, yes, but that's the price of sweet, cable-free progress. They'll ship to you in October 2016, assuming they hit the project goal of 50,000 – and since they're 4/5ths there at the time of writing, we don't expect that to be an issue.

**URL:** <http://kck.st/1rBPH7K>

**Funding Ends:** Thursday, 26th May 2016



*Disclaimer: Images shown may be prototypes and Micro Mart does not formally endorse or guarantee any of the projects listed. Back them at your own risk!*



# App Of The Week

# Audials Tunebite Platinum

Finally, an app that records, converts and plays everything we want

**W**e've looked at a few media conversion and stream recording utilities in the past, and they're all reasonably good. What we haven't found, though, is an app for recording from nearly every streaming service, which also offers media conversion and media playback. Until now.

Usually you have to rely on a selection of apps to get what you want. One for recording a video stream, another for music, a conversion app to get it in the right format to watch or listen to, and then another app to play the content. But there is a better solution: Audials Tunebite Platinum.

This extensive collection of tools lets you record both music and video streams from a host of popular sources, then save the content and convert it to a huge range of formats. It also features a media centre, which is optimised for smartphones and supports ID3 tags, album covers and so on.

## Tune-in

The list of features is impressive. The music recording covers Spotify, Groove, Deezer,

Apple Music and others. Likewise, the video streaming recording supports Netflix, iTunes, Hulu, Amazon, YouTube and more; you can even paste in an unfamiliar URL to record the streamed content.

The conversion process allows you to add individual files or folders, simply by dragging them into the main conversion selection window. It's a quick and easy process and one that supports pretty much every format going. Also, there's also a tool to allow you to make a backup of a DVD and save the converted content to your PC, a cloud location, a smartphone, a USB device or a NAS drive.

The media centre element is surprisingly good, considering it's a built-in service. You can choose the location of your music and video collection, as well as any other media files. From there, Tunebite Platinum will process the content and present it with the relevant album covers and other metadata.

## The Audials Collection

Audials Tunebite Platinum is a paid-for product, but remarkably it only costs £29.90,

## Features At A Glance

- Record audio and video streams from many popular sources.
- Converts audio and video to and from virtually any format.
- Copies DVDs for backup.
- Fully featured media centre built in.

when purchased from the Audials shop at [goo.gl/ijm2E0](http://goo.gl/ijm2E0).

What's more, Audials has a number of other high-quality products available, including a media centre and an internet radio streaming and recording package.

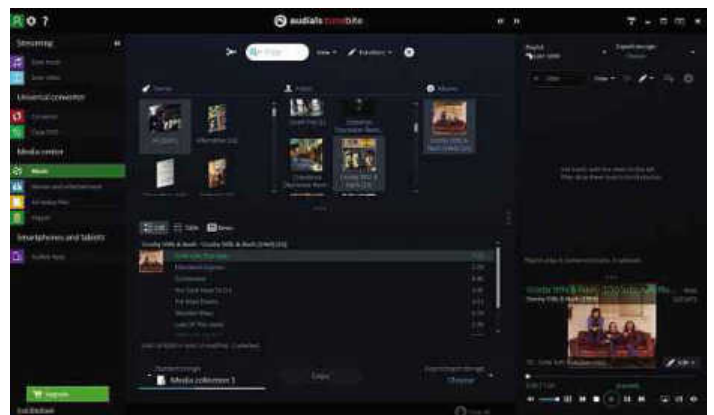
## Something For Everyone

We're quite impressed with what Tunebite Platinum has to offer. It's easy to use, the UI is uncluttered and simple to navigate, and it's excellent at recording from all our favourite streaming sources.

We're pretty sure there's something for everyone in here, and it's not too badly priced either. **mm**



▲ The media centre builds your collection, ready for playback



▲ Streaming music and recording is extremely easy



# Logging Off

One curse of the modern era is that we tend to overanalyse things, and often to the point of complete silliness. Take, for example, a recent story about the Heathrow-bound flight BA727 from Geneva that was reportedly hit by a drone on final approach. This story got very widespread coverage on TV news and in the printed press, where it was debated with some fervour that the lack of control of these devices had led inevitably to this life-threatening encounter.

Experts were lined up to say, unequivocally, that they had no idea what would happen if a drone entered the engine of a big jet, because nobody was prepared to pay the cost of an engine to find out. They were agree, however, that it certainly wouldn't be good.

What I found curious from the outset was how it was reported that the drone had hit the aircraft, when quite obviously it was the other way around. In general, when a pedestrian is run over by a car, we don't generally say that they hit the car, do we?

It's a speed thing, because it's easier for the faster moving object to avoid a collision, surely – unless I've got it all wrong, and that hedgehog I saw on the way to shopping was intentionally trying to ram oncoming traffic through a fit of environmental rage when he met his untimely demise.

So where was the broken drone, and how much damage did the less than iron-clad 1kg device do to the 64,000kg (take-off weight) Airbus A319?

The answers to those questions got much less coverage and expert analysis, because examination of the plane revealed no damage, not even scratched paintwork, and no bits of broken drone were located along the flight path.

Transport minister Robert Goodwill had this rather less newsworthy statement to make in the commons on the subject, "And indeed the early reports of a dent in the front of the plane were not confirmed – there was no actual damage to the plane, and there's indeed some speculation that it may have even been a plastic bag or something."

And at that point the buck passing started, as you might reasonably expected it to. Mr Goodwin pointed out that "the local police force that tweeted that they had a report of a drone striking an aircraft", handing the complete overreaction duties to the Met – which in turn said the pilot "believed a drone had struck the aircraft".

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What was revealed at this point was that numerous people have an agenda regarding drones, and they wanted this story to be true so much that they couldn't resist involving the media when zero concrete evidence existed that anything actually happened.

What's really annoying about this is that lots of people saw and read the initially scary drone story, but I'd contest many fewer heard that it was most likely a paper bag.

However, I haven't seen anyone yet demand that all paper bag users be registered, that they should have technology on them to stop them blowing away, or that they should be deployed within a wide radius of airports. But surely it's just a matter of time, isn't it?

And next week, I'll be discussing knives, and how in a modern society, it's surely about time they weren't allowed to be sharp and pointy at one end.

Mark Pickavance

## LAST WEEK'S CROSSWORD

**Across:** 7 Augustus Pugin, 8 Skewed, 9 Exabit, 10 Smitane, 12 Cubit, 14 Snark, 16 Leander, 19 Sienna, 20 Thwack, 22 Interferogram.

**Down:** 1 Punk, 2 Outwit, 3 Student, 4 Ashes, 5 Tuvalu, 6 Minimize, 11 Mentions, 13 Reuters, 15 Render, 17 New Age, 18 Gaffe, 21 Chat.

### DISCLAIMER

The views expressed by contributors are not necessarily those of the publishers. Every care is taken to ensure that the contents of the magazine are accurate but the publishers cannot accept responsibility for errors. While reasonable care is taken when accepting advertisements, the publishers cannot accept any responsibility for any resulting unsatisfactory transactions. A few months ago, we started watching *Star Trek: The Next Generation* from the beginning. We did have a break for a while, but this week we returned to it, to finish season three and begin season four in earnest. As much as we love the adventures of Picard and co., we're not sure the writers were fully

awake when they wrote some of the dialogue. For example, in one episode someone mentions using nanites for some reason, and one of the officers asks what nanites are. Is it just us, or does anyone else think that in the 24th century, pretty much everyone except toddlers should know what nanites are? Of course, such niggles are only the tip of the iceberg. If we really wanted to, we could ask why anyone walks anywhere on the ship when they could just use the transporter. Or why there's a bar with waiters when there's no money and people just need to ask a replicator to get their food and drink, making the staff redundant. Or we could just chill out and watch another episode. Yeah, we think we'll go with that...

## THIS WEEK'S CROSSWORD

### Across

- 7 Surface acoustics that travel on solids. (8,5)  
8 Formerly ShBoom and PSC 1000, this stack-based RISC microprocessor was introduced in 1994. (6)  
9 An inexperienced newcomer, especially in computing. (6)  
10 Search the internet for instances of one's own name or links to one's own website. (7)  
12 Conclude by reasoning. (5)  
14 A speech sound made with the vocal tract open. (5)  
16 The force of attraction between all masses in the universe. (7)  
19 Popular name for the cavernous Airbus A300-600ST super transporter aircraft. (6)  
20 Linux penguin? (6)  
22 Relating to the distribution or measurement of grain sizes in sand, rock or other deposits. (13)

### Down

- 1 Charging scheme where you're only debited for the mobile phone calls you actually make. (Abbr) (4)  
2 Demands for something as rightful or due. For example, insurance payments or compensation. (6)  
3 A portable gun. (7)  
4 A conductor having low resistance in parallel with another device to divert a fraction of the current. (5)  
5 .tw TLD (6)  
6 Immediately available in computer memory, rather than having to be loaded from elsewhere. (8)  
11 The branch of mathematics concerned with the properties and relations of points, lines, surfaces, solids and higher dimensional analogues. (8)  
13 The Japanese art of folding paper into shapes representing objects. (7)  
15 In the Ptolemaic system, an imaginary circle introduced with the purpose of reconciling the planetary movements with the hypothesis of uniform circular motion. (6)  
17 Excessive pride in or admiration of one's own appearance or achievements. (6)  
18 A live Linux operating system, that is optimised to preserve your privacy and anonymity. (5)  
21 The ROM flashing tool for Samsung Android smartphone and tablet devices. (4)





# In Next Week's Micro Mart\*

- Keep your PC safe with security hardware
- The best motherboards for overclocking
- How the QWERTY keyboard came to be and its influence today
- Plus the usual mix of news, features, reviews and advice



\* May be subject to change



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